53

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CONTENTS.

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

Part II.

General and Physical Chemistry.

PAGE

Piutti (A.). Molecular Asymmetry and Rotatory Power of Organic Substances . . . ii, 1

Landolt (H.). Method of Determining Rotatory Dispersion by the aid of Ray Filters . . . ii, 1

Bartoli (A.). Dependency of the Electrical Conductivity of Organic Salts on the Temperature . . . ii, 4

Chassy (A.). Electrolysis of Copper Sulphate . . . ii, 4

Toepler (M.). Volume Changes in Elements during melting . . . ii, 5

Bartoli (A.) and E. Stracciati. Change in the Specific Heat of Water between 0° and 32° . . . ii, 5

Bartoli (A.) and E. Stracciati. Specific Heat of Water at Constant Volume . . . ii, 6

Ramsay (W.). The Critical State . . . ii, 6

Guye (P. A.). Critical Density . . . ii, 6

Paterno (E.) and C. Montemartini. Volume Changes attending the mixture of Liquids in Relation to Cryoscopic Behaviour . . . ii, 6

Hamburger (H. J.). Determination of the Osmotic Pressures of Albuminous Liquids by the Cryoscopic Method . . . ii, 7

Jones (H. C.). Lowering of the Freezing Point . . . ii, 7

Muthmann (W.) and O. Kuntze. Solubility of Mixed Crystals of pairs of Isomorphous Salts . . . ii, 7

Lieben (A.). Relation between the Constitution of Fatty Acids and the solubility of their Salts . . . ii, 7

Guye (P. A.). Polymerisation of Liquid Molecules . . . ii, 8

Carrara (G.). Velocity of Reaction between Alkylic Sulphides and Alkylic Iodides . . . ii, 8

Meyer (L.). An Aluminium Air Bath . . . ii, 9

Muynck (R. De). Refractive Indices of Aqueous Solutions of Cadmium Salts . . . ii, 33

Eijkman (J. F.). Refractometric Observations . . . ii, 33

Liveing (G. D.) and J. Dewar. Spectrum of the Electric Discharge in Liquid Oxygen, Air, and Nitrogen . . . ii, 33

Skinner (S.). Clark Cell when Producing a Current . . . ii, 34

Warren (H. N.). Magnesium Voltaic Cell . . . ii, 35

Rothmund (V.). Potential Differences between Metals and Electrolytes . . . ii, 35

Kohlrausch (F.). Determination of the Resistance of Electrolytes . . . ii, 35

Tanatar (S.). Electrolytic Dissociation . . . ii, 36

Meyer (V.), W. Riddle, and T. Lamb. Melting Point Determinations at a Red Heat . . . ii, 36

Küster (F. W.). Melting Points of Mixtures of Isomorphous Salts . . . ii, 36

Dühring (U.). Law of Corresponding Boiling Points . . . ii, 37

Kahlbaum (G. W. A.) and C. G. v. Wirkner. Dühring's Law of Corresponding Boiling Points . . . ii, 37

PAGE
Dühring (U.). Law of Corresponding Boiling Points . . . . ii, 37
Spring (W.). Fluidity of Metals at Temperatures below their Melting Points . . . . ii, 37
Baly (E. C. C.) and W. **Ramsay**. Pressure, Volume, and Temperature Relations of Rarefied Gases . . . . ii, 38
Schmidt (G. C.). Adsorption . . . . ii, 39
Ramsay (W.). Passage of Hydrogen through a Palladium Septum . ii, 39
Ramsay (W.) and Miss E. **Aston**. Molecular Surface Energy of Ethereal Salts . . . . ii, 40
Ramsay (W.) and Miss E. **Aston**. Molecular Surface Energy of Mixtures of Non-associating Liquids . . . . ii, 40
Ramsay (W.). Complexity and Dissociation of Liquid Molecules . . ii, 40
Moore (B.). Relation between the Surface Tension and Osmotic Pressure of Solutions. . . . . ii, 41
Auwers (K.). Cryoscopic Molecular Weight Determinations . . . ii, 41
Tanatar (S.), J. **Choina**, and D. **Kozireff**. Freezing-point Depressions in Dilute Alcoholic Solution . . . . ii, 41
Pictet (R.). Influence of Low Temperatures on the Laws of Crystallisation . . . . ii, 42
Berthelot. Principle of Maximum Work and Entropy. . . . ii, 42
Andrews (L.). The Assumption of a Special Nascent State . . . ii, 43
Gregory (J. C.). Nascent State . . . . ii, 43
Étaix (L.). Extraction Apparatus . . . . ii, 43
Eijkman (J. F.). Refractometric Researches . . . . . . ii, 65
Walden (P.). Optical Rotation of Ions . . . . ii, 65
Le Roy (G. A.). Development of the Latent Photographic Image by Alkali Peroxides . . . . ii, 66
Bandrowski (E.). Light Emitted during Crystallisation . . . ii, 66
Swan (J. W.). Some Voltaic Combinations with a Fused Electrolyte and a Gaseous Depolariser . . . . ii, 66
Roszkowski (J.). Polarisation. I. Solid Cathodes . . . . ii, 67
Roszkowski (J.). Polarisation. II. Liquid Cathodes . . . . ii, 67
Wakeman (A. J.). Influence of Electrolytes on the Conductivity of Acetic acid . . . . ii, 68
Emery (G. F.). Thermoelectric Properties of Salt Solutions . . . ii, 68
Gray (J. H.). Method for Determining the Thermal Conductivity of Metals, with Applications to Copper, Silver, Gold, and Platinum . ii, 69
Joly (J.). Specific Heats of Gases at Constant Volume. Parts II and III. Carbonic Anhydride . . . . ii, 69
Kahlbaum (G. W. A.) and C. G. v. **Wirkner**. Law of Corresponding Boiling Points . . . . ii, 70
Traube (J.). Atomic and Molecular Solution Volumes . . . . ii, 70
Wesendonck (K.). The Critical State . . . . ii, 71
Abiegg (R.). Freezing Points of Concentrated Solutions . . . ii, 71
Behrend (R.). Solubility of Double Compounds . . . . . ii, 71
Roozeboom (H. W. B.). Graphical Representation of Heterogeneous Systems . . . . ii, 72
Traube (J.). Principles of a New System of the Elements . . . ii, 72
Brandstätter (F.). Lecture Experiments: Ethyl Ether . . . ii, 73
Berghoff (V.). Indices of Refraction of Solutions of Sulphur and Phosphorus in Carbon Bisulphide . . . . ii, 97
Welt (Miss I.). Saturated Hydrocarbons containing the Active Amyl Radicle . . . . ii, 97
Le Bel (A.). Attempts to resolve Unsaturated Compounds into Optically Active Constituents . . . . ii, 98
Freundler (P.). Rotatory Powers of Disubstituted Alkylic Tartrates . ii, 98
Guye (P. A.). Determination of the Molecular Weight of Liquids . ii, 99
Ostwald (W.). Scientific Electro-chemistry of the Present, and Technical Electro-chemistry of the Future . . . . ii, 99
Noll (K.). Thermoelectric Properties of some Metals . . . . ii, 99

PAGE

Knox (W. F.). Conductivity of Aqueous Solutions of Carbonic Anhydride . . . ii, 100
Luginin (W.). Heat of Vaporisation of Saturated Fatty Alcohols . ii, 101
Luginin (W.). Trouton's Law, and the Saturated Fatty Alcohols . . ii, 101
Stohmann (F.) and R. Schmidt. Heat of Combustion of Glycogen . ii, 102
Stohmann (F.) and H. Langbein. Thermochemistry of the Isomeric Acids of the Composition $C_7H_6O_3$ and $C_3H_8O_3$ . . . . . . ii, 102
Varet (R.). Mercuric Sulphates . . . . ii, 103
Ponsot (A.). Relation between the Vapour Pressures of a Substance in the Solid and Liquid State . . . . ii, 104
Prytz (K.) and H. Holst. Absorption Coefficient of Carbonic Anhydride and Hydrogen Sulphide in Water at the Freezing Point . . . ii, 104
Gunn (A.). New Reaction illustrating Dissociation . . . . . ii, 105
Wildermann (M.). Experimental Proof of the Laws of Van't Hoff, Arrhenius, and Ostwald for Dilute Solutions . . . . . . ii, 105
Wildermann (M.). Determination of the Freezing Point of Water . ii, 105
Pictet (R.). Freezing Point of Sulphuric acid Solutions . . . . ii, 106
Verschaffelt (J.). Pressure of Solution as a Means of Determining the Temperature of Change . . . . ii, 106
Laar (J. J. van). Correct Formulæ for Osmotic Pressure; Change of Solubility, Melting and Boiling Point; Heat of Solution and Dilution in Dissolved Dissociated Substances . . . . ii, 107
Löwenherz (R.). Rate of Hydrolysis of some Ethereal Salts . . ii, 107
Blanshard (C. T.). Position of Magnesium in the Genetic System of the Elements; Atomic Volumes; Allotropes and Isomerides . . . ii, 107
Ostwald (W.). The Chemometer . . . . ii, 108
Kalecsinszky (A. v.). Preservation of Chemically Pure Alkaline Solutions . . . . ii, 108
Guye (Phillipe A.) and M. Gautier. Superposing of the Optical Effects of different Asymmetric Carbon Atoms in the same Molecule . . ii, 149
Walden (Paul). Optical rotation of Amyl Derivatives . . . . ii, 149
Goldstein (Eugen). Action of the Cathode Discharge on some Salts . ii, 150
Cailletet (Louis P.) and Emmanuel Collardeau. Condensation of Electrolytic Gas by Porous Substances, especially Metals of the Platinum Group . . . . ii, 150
Berthelot (Marcellin). Condensation of Electrolytic Gas by Porous Substances, especially Metals of the Platinum Group. . . . ii, 150
Berthelot (Marcellin). Limits of Electrolysis . . . . . . ii, 151
Bagard (Henri). Thermoelectric Phenomena between two Electrolytes . . . . ii, 152
Peirce (Benjamin O.). Thermoelectric Properties of Platinoïd and Manganine . . . . ii, 152
Wolff (F. A., jun.). Influence of Magnetism on Chemical Action . . ii, 153
Guye (Phillipe A.). Formula of Van der Waals: $\log p_c - \log p = f\,Tc/T - f$ . . . . ii, 153
Dühring (Ulrich). Law of corresponding Boiling Points . . . ii, 154
Varet (Raoul). Mercuric Nitrates . . . . ii, 154
Beckmann (Ernst). Determination of Molecular Weights . . . ii, 154
Pictet (Raoul). Freezing Points of Mixtures of Alcohol and Water . ii, 155
Nernst (Walther) and Richard Abegg. Freezing Points of Dilute Solutions . . . . ii, 155
Noyes (Arthur A.) and W. R. Whitney. Cryoscopic Researches on Alkali Aluminates and Borates . . . . ii, 156
Holleman (Arnold F.) and A. C. Antusch. Solubility of Solid Non-electrolytes in Mixtures of Alcohol and Water . . . . . . ii, 156
Bancroft (Wilder D.). Ternary Mixtures . . . . ii, 157
Roozeboom (H. W. Bakhuis) and Frans A. H. Schreinemakers. Equilibrium between Liquid and Solid Phases . . . . . . ii, 158
Lichty (D. M.). Influence of the Substitution of Halogens in Acids on the Rate of Etherification . . . . ii, 159

PAGE
Kortright (Frederick L.). Effect of Hydrolysis on Reaction Velocities . . . ii, 159
Retgers (Jan W.). Isomorphism . . . ii, 160
Thaddéeff (Konstantin). Certain Regularities in the Weights of Drops of Molten Metals . . . ii, 161
Tollens (Bernhard). Lamp for the production of Formaldehyde . . . ii, 161
Maquenne (Léon). A new Laboratory Barometer . . . ii, 162
Edwards (Arthur M.). Substitute for Funnels in Filtering . . . ii, 162
Holde (D.). Simple Substitute for a Separating Funnel . . . ii, 162
Chorley (John C.). Constant Level Apparatus . . . ii, 162
Reiniger, Gebbert, and Schall. Sodium Press as modified by E. Beckmann . . . ii, 163
Loesner (Hans). Two new Laboratory Apparatus . . . ii, 163
Edwards (W. F.). New Formula for Specific and Molecular Refraction ii, 193
Thiele (Edmund). Spectrophotometric Researches on Iodine Solutions . ii, 193
Brühl (Julius W.). Spectrochemistry of Nitrogen . . . ii, 194
Freundler (P.). Rotatory Power of Dissolved Substances . . . ii, 194
Guye (Phillipe A.) and J. Fayollat. Ethereal Tartrates . . . ii, 195
Guye (Phillipe A.) and M. Gautier. Superposition of the Optical Effects of Different Carbon Atoms in the same Active Molecule . ii, 195
Schönrock (Otto). Magnetic Rotation of Solutions of Hydrogen Chloride . . . ii, 196
Gouré de Villemonteé (G.). Electric Potentials in a Liquid Conductor in Uniform Movement . . . ii, 197
Fessenden (Reginald A.). Measurement of the Specific Inductive Capacities of Water, Alcohol, &c. . . . ii, 198
Jahn (Hans) and Otto Schönrock. Thermodynamics of Galvanic Polarisation . . . ii, 198
Blanshard (Charles T.). Rôle of Atomic Heat in the Periodic Series of the Elements . . . ii, 198
Grodspeed (A. W.) and Edgar F. Smith. Specific Heat of Tungsten . ii, 199
Petrini (H.). Specific Heat of Gases . . . ii, 199
Griffiths (Ernest H.). Influence of Temperature on the Specific Heat of Gases . . . ii, 199
Pictet (Raoul) and Michael Altschul. Critical Temperature as a Test of the Purity of Liquids . . . ii, 200
Pictet (Raoul). Critical Temperature of Liquids Holding Solids in Solution . . . ii, 201
Jorissen (W. J.) and E. van de Stadt. Heat of Combination of Water of Crystallisation of Organic Compounds . . . ii, 202
Massol (Gustave). Thermal Properties of Nitrobenzoic acids . . . ii, 202
Young (Sydney). Influence of the Relative Volumes of Liquid and Vapour on the Vapour-pressure of a Liquid at Constant Temperature . . . ii, 203
Jahn (Hans) and E. Schröder. The Relation between Dissociation and Temperature . . . ii, 203
Traube (Isidor). Certain Regularities in the Weights of Drops of Molten Metals . . . ii, 203
Tammann (Gustav). Volume Change on Neutralisation . . . ii, 204
Pictet (Raoul) and Michael Altschul. Freezing Point of Liquid Mixtures . . . ii, 204
Paternò (Emanuele) and Clemente Montemartini. Maximum Depression of the Freezing Point of Mixtures . . . ii, 205
Garelli (Felice) and C. Montanari. Cryoscopic Behaviour of Substances having Constitutions similar to that of the Solvent . . . ii, 205
Garelli (Felice). Freezing Points of Isomorphous Mixtures . . . ii, 206
Ponsot (A.). Reduction of the Freezing Point of Dilute Solutions of Sodium Chloride . . . ii, 206
Altschul (Michael) and B. v. Schneider. Freezing Points of some Organic Liquids . . . ii, 206

PAGE

Paternò (Emanuele) and Clemente Montemartini. Paraxylene as the Solvent for Cryoscopic Investigations . . . . . . ii, 207
Noyes (Arthur A.) and Charles G. Abbot. Solubility Experiments . ii, 207
Pickering (Spencer U.). Some Properties of Calcium Chloride Solutions. I. Freezing Points. II. Heats of Dissolution. III. Densities . . . . ii, 208
Köppe (H.). New Method for the Determination of Isosmotic Concentrations . . . . ii, 208
Stortenbecker (Willem). Mixed Crystals of the Chlorides of Cobalt and Nickel . . . . ii, 209
Traube (Isidor). Method of Determining Molecular Weight and Constitution . . . . ii, 209
Trevor (Joseph E.) and Frederick L. Kortright. Chemical Equilibria as Temperature Functions . . . . ii, 211
Schwicker (Alfred). Reaction Velocity of Potassium Hypoiodite . ii, 213
Ewan (Thomas). Rate of Oxidation of Phosphorus, Sulphur, and Aldehyde . . . . ii, 213
Kahlbaum (Georg W. A.). Apparatus for Fractional Distillation under very Low Pressures . . . . ii, 215
Schon (C. V.). Laboratory Apparatus . . . . ii, 215
Volhard (Jakob). Improved Laboratory Apparatus . . . . ii, 216
Sauer (Ewald). A New Shaking and Stirring Apparatus . . . ii, 216
Kahlbaum (Georg W. A.). Simple Centrifugal Apparatus . . . ii, 216
Lemoine (Georges). Measurement of the Intensity of Light by the Chemical Changes produced in a Mixture of Ferric Chloride and Oxalic Acid . . . . ii, 249
Zoppellari (I.). Atomic Refraction of Selenium . . . . . . ii, 249
Brühl (Julius W.). Spectrochemistry of Nitrogen . . . . ii, 250
Anschütz (Richard) and Hans Reitter. Optical Rotation of Ethereal Salts of Malic Acid . . . . ii, 251
Smale (Fred. J.). Gas Batteries—a correction . . . . . . ii, 251
Strecker (Karl). Electrical Conductivity . . . . ii, 252
Warburg (Emil). Electrical Conductivity and Convection in Dilute Solutions of small Conductivity . . . . ii, 252
Franke (Emil). Electrical Conductivity in Aqueous Solutions . . ii, 252
Pictet (Raoul). Radiation at Low Temperatures . . . . . . ii, 253
Bartoli (Adolfo) and Enrico Stracciati. Correction for Thermochemical Measurements . . . . ii, 254
Rivals (Paul). Acid Chlorides and Chloraldehydes . . . . . ii, 254
Berthelot (Marcellin) and Camille Matignon. Barium nitride . ii, 255
Monnet (E.). Calorimetric Behaviour of Saline Sodium Acetate Solutions ii, 255
Villard (P.). Dissolution of Solids in Vapours . . . . . . ii, 255
Linebarger (C. E.). Application of the Schroeder-Le Chatelier Law of Solubility to Solutions of Salts in Organic Liquids . . . . ii, 256
Tolloczko (St.). New Application of the Principle of the Reduction of Solubility to the Determination of Molecular Weights . . . ii, 256
Küster (Fritz W.). Isomorphous Mixtures . . . . ii, 257
Boisbaudran (Paul E. Lecoq de). Atomic Weights . . . . ii, 257
Noyes (Arthur A.). Velocity of the Reaction between Ferric and Stannous Chlorides . . . . ii, 257
Petersen (Emil). Velocity of Etherification of Methylic Alcohol . ii, 258
Skraup (Zdenko H.). Relative Affinities of Organic Bases in Alcoholic Solution . . . . ii, 259
Prati (Ugo). The Formation of Oximes. . . . . ii, 259
Georgievics (Georg v.). Theory of dyeing . . . . ii, 259
Mangold (Carl). Apparatus for Reflux Condensation and for Distillation . . . . ii, 260
Aubin (Émile). New Muffle . . . . ii, 260
Volhard (Jakob). Lecture Experiments—Gain of Weight in Combustion . . . . ii, 260

PAGE

Rimbach (Eberhard). Dissociation and the Optical Rotation of Active Compounds . . . . ii, 301
Carrara (Giacomo) and G. Gennari. Relation between Electrolytic Dissociation and Optical Rotation . . . . ii, 301
Carrara (Giacomo). Electrolytic Dissociation and the Law of Dilution in Organic Solvents . . . . ii, 302
Korda (Désiré). Thermochemical Carbon Battery . . . . ii, 302
Luggin (H.). Electrocapillary Phenomena . . . . ii, 303
Barillot (Ernest). New Fractionating Column . . . . . ii, 303
Anderlini (Francesco) and R. Salvadori. Comparative Investigation of the Methods of Fractional Distillation . . . . . . ii, 304
Young (Sydney) and G. L. Thomas. Dephlegmator for Fractional Distillation . . . . ii, 304
Knietsch (Rudolf). The Critical Temperature as a Criterion of Chemical Purity . . . . ii, 304
Tassilly. Thermal Constants of Calcium Oxybromide and Oxyiodide . ii, 304
Varet (Raoul). Heat of Formation of Mercuric Salts . . . . ii, 305
Varet (Raoul). Isomeric Mercuric Oxides . . . . ii, 305
Le Chatelier (Henri L.). Heats of Formation of some Iron Compounds . . . . ii, 305
Rivals (Paul). Chloraldehydes . . . . ii, 306
Rivals (Paul). Crystallised Polymeride of Chloraldehyde . . . ii, 307
Alvisi (Ugo). Relation between the Molecular Weight and Density of Liquid and Solid Substances . . . . ii, 307
Zepernick (K.) and Gustav Tammann. Volumes of Aqueous Salt Solution between 100° and 150° . . . . ii, 307
Traube (Isidor). Cause of Osmotic Pressure and Ionisation (Electrolytic Dissociation) . . . . ii, 308
Traube (Isidor). Molecular Weight Determinations of Solid Liquid and Dissolved Substances . . . . ii, 308
Bodländer (Guido). Solubility in Mixtures of Alcohol and Water . ii, 308
Retgers (Jan. W.). Isomorphism . . . . ii, 309
Wegscheider (Rudolf). Affinity Constants of Dibasic Acids and of Acid Ethereal Salts . . . . ii, 310
Trübsbach (P. A.). Affinity Constants of Ureïdes and Isonitroso-derivitives . . . . ii, 310
Pupin (M. I.). Automatic Vacuum Pump . . . . ii, 311
Berthelot (Marcellin). Spectra of Argon and the Aurora Borealis . ii, 337
Berthelot (Marcellin). Argon and its Fluorescence Spectrum . . ii, 337
Gramont (Arnaud de). Spectra of Selenium and Natural Selenides . ii, 338
Freundler (P.). Variations in the Rotatory Power of Tartrates . . ii, 338
McCrae (John). Measurement of High Temperatures and the Melting Points of some Inorganic Salts . . . . ii, 339
Forch (Carl). Thermal Expansion of Aqueous Solutions . . . ii, 339
Berthelot (Marcellin). Relationship between the Latent Heats of Vaporisation and Fusion of Substances belonging to the same Family . . . . ii, 339
Blanshard (Charles T.). Melting Points of the Elements as a Clue to their Genesis . . . . ii, 340
Wolpert (H.). Percussive Ebullition . . . . ii, 340
Berthelot (Marcellin). Relations between the Multiple Proportions of Chemical Compounds and their Heats of Formation . . . ii, 340
Berthelot (Marcellin). Thermochemical Researches on Substitution in Mineral Chemistry . . . . ii, 341
Forcrand (Robert de). Heat of Formation of Calcium Carbide . . ii, 341
Forcrand (Robert de). Compounds of Calcium and Barium Oxides with Alcohol . . . . ii, 341
Tasilly. Thermochemistry of Barium and Strontium Iodides . . ii, 342
Bauer (Gustav). Specific Gravity of Saturated Vapours . . . ii, 342
Coppet (L. C. de). Temperature of Maximum Density of Water . . ii, 343

PAGE
Coppet (L. C. de). Temperature of Maximum Density and Freezing Points of Cane Sugar Solutions . . . . ii, 343
Étard (Alexandre L.). Saturated Solutions . . . . . . ii, 344
Přibram (Richard). Burner for Monochromatic (Sodium) Light . . ii, 345
Wolpert (H.). Improvements in Glass Stopcocks . . . . . ii, 345
Přibram (Richard). Simple Percolator . . . . ii, 345
Berlemont. Safety Valve for Filter Pumps . . . . . . ii, 346
Coggeshall (George W.). Constancy of the Calomel Electrode . . ii, 377
Bartoli (Adolfo). Electrical Conductivity near the Critical Temperature . . . . ii, 377
Spring (Walter). Specific Heat of Hydrogen Peroxide . . . ii, 377
Berlemont. Thermostat . . . . ii, 378
Bruner (Louis). Solidification of Some Carbon Compounds . . . ii, 378
Michael (Arthur). Melting Point of Difficultly Fusible Organic Compounds . . . . ii, 378
Kahlbaum (Georg W. A.). Determination of Boiling Points by the Dynamical Method . . . . ii, 379
Natanson (Ladislaus). Critical Temperature of Hydrogen . . . ii, 379
Hoff (Jacobus H. van't), Heinrich Goldschmidt, and W. P. Jorissen. Transition Temperatures of some Racemates . . . . . . ii, 380
Varet (Raoul). Heat of Combination of Mercury with other Elements . . . . ii, 380
Varet (Raoul). Heats of Formation of Mercurous Sulphate, Nitrate, and Acetate . . . . ii, 380
Varet (Raoul). Heats of Formation of Mercurous Chloride, Bromide, Iodide, and Oxide . . . . ii, 381
Molinari (Ettore). Nature and Cause of Osmotic Pressure . . . ii, 381
Hedin (S. G.). Determination of Isosmotic Concentrations . . . ii, 381
Goldschmidt (Heinrich). Increase of Solubility by the Addition of Non-Electrolytes . . . . ii, 382
Beckmann (Ernst) and August Stock. Determination of Molecular Weights . . . . ii, 382
Andrews (Launcelot N.) and Carl Ende. Physical Properties of Solutions of Lithium Chloride in Amylic Alcohol . . . . . . ii, 383
Boisbaudran (Paul E. Lecoq de). Formation of Crystals at the Bottom of a Solution heavier than themselves . . . . . . ii, 384
Trevor (Joseph E.). Law of Mass Action . . . . ii, 384
Menschutkin (N.). Velocity of Formation of Amines and of Alkylic Ammonium Salts . . . . ii, 385
Kastle (J. H.) and B. C. Keiser. Determination of the Affinities of Acids Colorimetrically by means of Potassium Dichromate . . . ii 386
Monnet (Paul). Apparatus for Fractional Distillation . . . . ii 387
Bandrowski (Ernst). Emission of Light during Crystallisation . . ii, 429
Edwards (W. F.). Molecular and Atomic Refraction . . . . ii, 429
Lockyer (J. Norman). Spectra of Gases evolved from certain Minerals. ii, 430
Deslandres (Henri). Spectra of Gases from Cleveite and the Solar Spectrum . . . . ii, 431
Hartley (W. Noel). Variations observed in the Spectra of Carbon Electrodes . . . . ii, 432
Hartley (W. Noel). Flame Spectra at High Temperatures. Spectrum of Metallic Manganese, of Alloys of Manganese, and of Compounds containing that Element . . . . ii, 432
Hartley (W. Noel). Flame Spectra at High Temperatures. The Spectroscopic Phenomena and Thermochemistry of the Bessemer Process . . . . ii, 432
Ewan (Thomas). Absorption Spectra of Dilute Solutions . . . ii, 433
Macnab (William) and E. Ristori. Researches on Modern Explosives . . . . ii, 434
Rudolphi (Max). Heats of Solution and Dissociation . . . . ii, 435
Varet (Raoul). Isomeric Changes of Mercury Compounds . . . ii, 435

PAGE
Berthelot (Marcellin) and Paul Rivals. Thermochemical Relations between Aldehydes, Alcohols, and Acids . . . ii, 435
Ponsot (A.). Cryosalts . . . ii, 438
Roloff (Max). Cryohydrates . . . ii, 438
Küster (Fritz W.). Molecular Weight Determinations in Solid Solution . . . ii, 439
Seubert (Karl). History of the Periodic System . . . ii, 439
Boisbaudran (Paul E. Lecoq de). Classification of the Chemical Elements . . . ii, 440
Friedel (Charles). Classification of the Chemical Elements . . . ii, 440
Lea (M. Carey). The Colour of Atoms, Ions, and Molecules . . . ii, 441
Baly (Edward C. C.). Possible Explanation of the Two-fold Spectra of Oxygen and Nitrogen . . . ii, 469
Berthelot (Marcellin). Fluorescence of Argon and its combination with the Elements of Benzene . . . ii, 469
Lockyer (J. Norman). New Gas obtained from Uraninite . . . ii, 470
Gramont (Arnaud de). Direct Spectrum Analysis of Minerals and Fused Salts . . . ii, 470
Ewan (Thomas). Absorption Spectra of Dilute Solutions . . . ii, 471
Liveing (George D.) and James Dewar. Refraction and Dispersion of Liquid Oxygen and the absorption of Liquid Air . . . ii, 471
Guye (Philippe A.) and Charles Jordan. Active Salts of the α-Hydroxybutyric Acids . . . ii, 471
Guye (Philippe A.) and P. do Amaral. Optical activity of Amylic Derivatives in the state of Liquid and Vapour . . . ii, 472
Guye (Philippe A.). Molecular Rotation and Molecular Deviation . . . ii, 473
Colson (Albert). Guye's Formula . . . ii, 473
Rodger (James W.) and W. Watson. Magnetic Rotation of the Plane of Polarisation of Light in Liquids. Part I. Carbon Bisulphide and water . . . ii, 474
Limb (C.). E.M.F. of the Clark, Gouy, and Daniell Standards . . . ii, 475
Thomson (Joseph J.). Electrolyses of Gases . . . ii, 475
Whetham (W. C. Dampier). Velocities of the Ions . . . ii, 477
Morgan (J. L. R.). Dissociation of Cyanides . . . ii, 478
Teclu (Nicolae). Flames . . . ii, 478
Hite (H. B.). New Boiling Point Apparatus for Molecular Weight Determinations . . . ii, 479
Orndorff (William R.) and F. K. Cameron. New Boiling Point Apparatus for Molecular Weight Determinations . . . ii, 480
Stoney (G. Johnstone). Motions of, and within, the Molecules, and on the significance of the two Specific Heats of Gases . . . ii, 481
Bruner (Louis). Specific Heat of Superfused Salts . . . ii, 482
Forcrand (Robert de). Heat of Formation of Sodium Acetylide . . . ii, 482
Stohman (Fr.) and Raymund Schmidt. Calorimetric investigations. Heat Equivalents of the Amides and Anilides of Monobasic Acids . . . ii, 482
Rivals (Paul). Phthalic Chloride and Phthalide . . . ii, 483
Berthelot (Marcellin) and Paul Rivals. Campholenic Lactones . . . ii, 484
Laar (J. J. van). Calculation of the Heat of Dissolution . . . ii, 484
Jahn (Hans). Calculation of the Heat of Dissolution . . . ii, 484
Berthelot (Marcellin). Heat of Dissolution and Neutralisation of Campholenic Acids . . . ii, 484
Hoff (Jacobus van't) and Heinrich Goldschmidt. Wyrouboff's Racemate . . . ii, 485
Ladenberg (Albert). Racemism, and Changes of Temperature on Mixing Liquids . . . ii, 485
Berkeley (Earl of). Determination of the Specific Gravity of Solids . . . ii, 485
Müller-Erzbach (Wilhelm). Vapour Pressure of the Combined Water in Copper Sulphate and Barium Chloride . . . ii, 486
Boisbaudran (Paul E. Lecoq de). Volume of Salts in their Aqueous Solutions . . . ii, 486, 487

PAGE

Raoult (**François M.**). Osmotic Phenomena between Ether and Methylic Alcohol with different Diaphragms . . . . . . ii, 487
Köppe (**H.**). Determination of Isosmotic Concentrations. . . . . ii, 488
Salzer (**Thomas**). Water of Crystallisation . . . . ii, 488
Bruner (**Louis**). Solubility of Superfused Salts . . . . . . ii, 488
Vaubel (**Wilhelm**). Solubility of Benzene Derivatives in Water . . ii, 489
Arctowski (**Henryk**). Solubility of Carbon Compounds in Carbon Bisulphide at Low Temperatures . . . . ii, 489
Ladenburg (**Albert**). Molecular Symmetry and Asymmetry . . ii, 489
Rudolphi (**Max**). Calculation of Affinity Constants . . . . . ii, 490
Bredig (**Georg**). Influence of Centrifugal Force on Chemical Systems . ii, 490
Pringsheim (**Nathanael**). Precipitates in Gelatinous Solutions . . ii, 491
Thomsen (**Julius**). Systematic Arrangement of the Elements . . ii, 491
Ostwald (**Wilhelm**). Methods of Physico-Chemical Measurements . ii, 491
Bigot (**C.**). A Gas Furnace . . . . ii, 491

Inorganic Chemistry.

Meyer (**L.**) and **K. Seubert**. Ratio of the Atomic Weights of Hydrogen and Oxygen . . . . ii, 9
Angeli (**A.**). A New Explosive Mixture . . . . ii, 9
Schär (**E.**). Hyposulphurous acid . . . . ii, 9
Gurcman (**A.**). Electrolysis of Nitrosylsulphuric acid in Sulphuric acid Solution . . . . ii, 10
Curtius (**T.**) and **F. Schrader**. Metallic Double Salts of Diammonium and Diamide . . . . ii, 10
Emich (**F.**). Action of Nitric Oxide on Metals at High Temperatures . ii, 11
Lunge (**G.**) and **G. Porschnew**. Nitrous Anhydride . . . . ii, 12
Retgers (**J. W.**). Preparation of Hydrogen Phosphide . . . . ii, 13
Friedel (**C.**). Thiohypophosphates. . . . . ii, 13
Salzer (**T.**). Sodium Pyrophosphates . . . . ii, 14
Kassner (**G.**). Orthoplumbates of the Alkaline Earths . . . . ii, 14
Arctowski (**H.**). Volatility of Mercuric Chloride . . . . . ii, 15
Dennis (**L. M.**) and **W. H. Magee**. Cerium Compounds. . . . ii, 15
Prelinger (**O.**). Nitrogen Compounds of Manganese . . . . ii, 16
Le Chatelier (**H.**). Manganese Steel . . . . ii, 16
Lightfoot (**M.**). Chemical Behaviour of Arsenical Pyrites . . . ii, 17
Seubert (**K.**) and **R. Rohrer**. Action of Ferric Sulphate on Potassium Iodide and Hydriodic acid . . . . ii, 17
Smith (**E. F.**) and **H. C. Burr**. Attempt to prepare Molybdenum Hexachloride . . . . ii, 18
Rosenheim (**A.**). Salts of Sulphomolybdic acid . . . . . ii, 18
Alvisi (**V.**). Complex Inorganic Acids . . . . ii, 18
Schmidt (**F. W.**). A New Oxysulphide of Tin . . . . . . ii, 19
Lossen (**C.**). New Method of Extracting Gold from Auriferous Ores by means of Bromine . . . . ii, 19
Moureu (**C.**). Action of Thionyl Chloride on Inorganic and Organic Acids and Aldoximes . . . . ii, 43
Ilosvay de Nagy Ilosva (**L.**). Secondary Products containing Nitrogen formed during Combustion in Air . . . . ii, 44
McLeod (**H.**). Schuller's Yellow Modification of Arsenic . . . ii, 44
Villard (**P.**). Hydrate of Carbonic Anhydride: Composition of Gaseous Hydrates . . . . ii, 44
Schottländer (**P.**). Triammonium Orthophosphate . . . . . ii, 45
Schneider (**E. A.**). Colloidal Silver . . . . ii, 45
Tassilly. Basic Calcium Salts . . . . ii, 45
Schneider (**E. A.**). Action of Phosphorus Trichloride on Magnesium Nitride . . . . ii, 46

PAGE
Burcker (E.). Stability of Aqueous Solutions of Mercuric Chloride . ii, 46
Meyer (V.). The Molecular State of Mercurous Chloride Vapour . . ii, 46
Neumann (G.). Double Salts of Higher Chlorides of Manganese and Copper . . . . ii, 46
Jörgensen (S. M.). Constitution of Cobalt, Chromium, and Rhodium Bases . . . . ii, 47
Fleck (H.) and E. F. Smith. Molybdamide . . . . ii, 48
Locke (J.). Thorium Metaoxide and its Hydrate . . . . . ii, 49
Robinson (H. L.). Vanadium in Commercial Caustic Soda . . . ii, 49
Christomanos (A. C.). Artificial Ice . . . . ii, 73
Wolffenstein (R.). Concentration and Distillation of Hydrogen Peroxide . . . . ii, 73
Ilosvay de Nagy Ilosva (L.). Bye-products formed in the Interaction of Ozone and Ammonia . . . . ii, 74
Duden (P.). Formation of Hydrazine from Inorganic Compounds . . ii, 74
Hantzsch (A.). Salts of Nitrosulphonic acid . . . . . . ii, 75
Joannis (A.). Action of Hydrogen Phosphide on Potassammonium and Sodammonium . . . . ii, 75
Arzruni (A.) and E. Schütz. Crystallised Products formed in the Deacon Chlorine Process . . . . ii, 75
Wetzner (R.). Combination of Hydrogen Fluoride with Water . . ii, 108
Wiedemann (E.) and G. C. Schmidt. Formation of Ozone by the Action of Electric Oscillations . . . . ii, 109
Dosmond. Gases from Wood Charcoal at a High Temperature . . ii, 109
Michaud (G.). Influence of certain Metals on the Stability of Ammonium Amalgam . . . . ii, 109
Kraut (K.). Ammonium Orthophosphate . . . . ii, 109
Robineau (F.) and G. Rollin. Presence of Ammonia in Zinc Powder . ii, 109
Spring (W.). Conversion of Black Mercuric Sulphide into the Red Modification: Density and Specific Heat of the Two Forms . . ii, 110
Charpy (G.). Temperatures of Transformation of Irons and Steels. . ii, 110
Seubert (K.) and R. Rohrer. Action of Ferric Acetate on Potassium Iodide and Hydrogen Iodide . . . . ii, 111
Schneider (E. A.). Methods of Removing Phosphoric acid or Alkali Phosphates from the Phosphates of Calcium and Iron . . . ii, 112
Kehrmann (F.) and E. Böhm. Complex Inorganic Acids: Phosphoduodecimolybdic acid and Phospholuteomolybdic acid . . . ii, 112
Herty (C. H.). Mixed Double Haloïds of Antimony and Potassium . ii, 113
Baubigny (H.). Antimony Vermilion . . . . ii, 114
Schneider (R.). Atomic Weight of Bismuth . . . . . . ii, 114
Linebarger (C. E.). Combination of Sulphur with Iodine . . . ii, 163
Chikashigé (Masumi). Preparation of Nitric Oxide . . . . ii, 163
Higley (George O.). Action of Nitric acid on Metals . . . . ii, 164
Moissan (Henri). Volatilisation of Carbon . . . . . . ii, 164
Walden (P. T.). Double Chlorides and Bromides of Cæsium, Rubidium, Potassium, and Ammonium with Ferric Iron. Ferrosoferric Double Bromides . . . . ii, 165
Campbell (George F.). Cæsium Cobalt and Cæsium Nickel Double Haloïds . . . . ii, 165
Lea (M. Carey). Solutions of Metallic Silver . . . . . . ii, 166
Schneider (Edward A.). Action of Dry Hydrogen Chloride on Serpentine . . . . ii, 166
Lepierre (Charles). Atomic Weight of Thallium. . . . . . ii, 166
Meyer (Victor). The Molecular State of Mercurous Chloride Vapour . ii, 166
Franck (Léon). Action of Aluminium Chloride on Carbon and its Compounds. . . . . ii, 167
Winkler (Clemens). Atomic Weight of Nickel and Cobalt . . . ii, 167
Moore (Thomas). Action of Reducing Agents on Potassium Nickelocyanide; Magnetic Oxide of Nickel . . . . ii, 168
Schneider (Edward A.). Titanium . . . . ii, 169

PAGE

Lea (M. Carey). New Methods of obtaining Platinosochlorides; probable existence of a Platinum Subchloride . . . . ii, 170
Maillfat (l'Abbé). Solubility of Ozone in Water . . . . . . ii, 216
Stokes (Henry N.). Phosphorus Chloronitride . . . . . . ii, 217
Stavenhagen (Alfred). The Arsenites . . . . ii, 217
Moissan (Henri). Graphite . . . . ii, 219
Moissan (Henri). Displacement of Carbon from Fused Cast Iron by Boron and Silicon . . . . ii, 220
Moissan (Henri). Graphites from Iron . . . . ii, 220
Moissan (Henri). Intumescent Graphite . . . . ii, 221
Deninger (Albert). Carbon Monosulphide . . . . ii, 222
Vigouroux. Preparation of Amorphous Silicon . . . . . . ii, 222
Reychler (Albert). Constitution of Silver Ammonia Compounds . ii, 222
Ditte (Alfred). Silver Sulphide . . . . ii, 223
Fonzes-Diacon. Solubility of Strontium Bromide in Alcohol . . ii, 223
Combes (Alphonse). Valency of Beryllium . . . . ii, 224
Villiers (A.). Zinc and Manganese Sulphides and the Protomorphic State . . . . ii, 224
Werner (Alfred). Constitution of Inorganic Compounds . . . ii, 225
Arctowski (Henryk). Double Decomposition between Gaseous Compounds . . . . ii, 225
Fileti (Michele). The Molecular Weight of Mercurous Chloride . ii, 225
Moissan (Henri). Reduction of Aluminium by Carbon . . . ii, 226
Sabatier (Paul). Hydrated Metallic Chlorides . . . . . . ii, 226
Lepierre (Charles). Iron Chromates . . . . ii, 227
Villiers (A.). Metallic Sulphides . . . . ii, 227
Villiers (A.). Nickel and Cobalt Sulphides . . . . . . ii, 228
Piccini (Augusto). Green Chromic Chloride . . . . . . ii, 229
Gibbs (Wolcott). Complex Inorganic Acids . . . . ii, 229
Pennington (Mary E.) and Edgar F. Smith. Atomic Weight of Tungsten . . . . ii, 230
Smith (Edgar F.) and En. D. Desi. Atomic Weight of Tungsten . ii, 230
Serono (C.). Pyroantimonious acid . . . . ii, 231
Morley (Edward W.). Atomic Weight of Oxygen . . . . . ii, 261
Tittinger (Emil). Solubility of Precipitated Sulphur in Carbon Bisulphide . . . . ii, 261
Veley (Victor H.). Hydrate of Nitric acid: Action of Nitric acid on Organic Compounds . . . . ii, 262
Hoff (Jacobus H. van't). Products formed in the Slow Oxidation of Phosphorus . . . . ii, 262
Vigouroux. Amorphous Silicon . . . . ii, 263
Vigouroux. Analyses of Silicon . . . . ii, 264
Arth (Georges). Action of Water on Coal . . . . ii, 264
Békétoff (Nicolai N.). Haloïd Salts of Cæsium . . . . . ii, 264
Békétoff (Nicolai N.). Action of Hydrogen on Cæsium Oxide . . ii, 265
Cohen (Ernst). Action of Hydrogen on Photographic Dry Plates. . ii, 265
Venable (Frank P.) and Thomas Clarke. Properties of Calcium Carbide . . . . ii, 265
Villiers (A.). Transformations of Zinc Sulphide . . . . . ii, 266
Villiers (A.). Crystallisation of Precipitates: Zinc and Manganese Sulphides and Copper Hydroxide . . . . ii, 267
Villiers (A.). Basic and Acidic Zinc Sulphide . . . . . . ii, 267
Warburg (Emil). Action of the Silent Discharge on Lead Oxide . . ii, 267
Norris (R. S.). Action of Light on Lead Bromide . . . . . ii, 267
Mosnier (A.). Combination of Lead Iodide with Metallic Iodides and with Organic Iodides . . . . ii, 268
Bartlett (Edwin J.) and Walter Merrill. Cupric Hydride . . ii, 268
Jones (Harry C.). Atomic Weight of Yttrium . . . . . . ii, 269
Lescœur (Henri). Hydrated Metallic Chlorides . . . . . ii, 269
Moissan (Henri) and Georges Charpy. Boron Steel . . . . ii, 269

PAGE
Moissan (Henri). Iron Boride . . . . ii, 270
Thomas (V.). Combination of Nitric Oxide with Ferric Chloride . . ii, 271
Garnier (Jules). Action of an Electrical Current on Fused Metallic Sulphides . . . . ii, 271
Wyrouboff (Grégoire). Amidochromates . . . . ii, 272
Moissan (Henri). Titanium . . . . ii, 272
Ditte (Alfred). Bismuth Sulphide . . . . ii, 273
Ditte (Alfred). Gold Sulphide . . . . ii, 274
Gibbs (Wolcott). Complex Inorganic acids . . . . ii, 274
Sabatier (Paul) and J. B. Senderens. Action of Nitrous Oxide on Salts and Metallic Oxides . . . . ii, 312
Arctowski (Henryk). Action of Heat on Carbon Bisulphide . . ii, 312
Bayer (R. S.). New Element from Bauxite . . . . . . ii, 313
Richards (Theodore W.). Atomic Weight of Strontium . . . ii, 314
Athanasescu (Nicoles). Basic Nitrates . . . . ii, 315
Senderens (J. B.). Precipitation of Metallic Lead . . . . . ii, 315
Minor (Wilhelm). Preparation of Lead Dioxide . . . . . ii, 315
Senderens (J. B.). Lead Orthonitrate . . . . ii, 316
Giorgis (Giovanni). Thallium Hydrogen Carbonate . . . . ii, 316
Brauns (Reinhard). Action of Dry Hydrogen Chloride on Serpentine . ii, 316
Hibbs (Joseph G.) and Edgar F. Smith. Action of Magnesium on Manganous Salts . . . . ii, 316
Brown (Amos P.). Chemical Character of Pyrites and Marcasite . . ii, 316
Hofmann (Karl A.) and O. F. Wiede. New Nitroso-Compounds of Iron ii, 317
Winkler (Clemens). Atomic Weights of Nickel and Cobalt . . ii, 318
Schottländer (Paul). Colloidal Gold . . . . ii, 318
Fasbender (R.). Double Chlorides of the Alkali Metals and Gold . . ii, 319
Spring (Walter). Colour, Specific Gravity, and Surface Tension of Hydrogen Peroxide . . . . ii, 346
Brauner (Bohuslav). Gases of the Helium and Argon Type . . ii, 347
Clève (Per T.). Helium in Cleveite . . . . ii, 347
Guntz (Antoine). Demonstration of the Presence of Argon in the Atmosphere . . . . ii, 347
Bruyn (Cornelius A. Lobry de). Free Hydrazine . . . . ii, 347
McLeod (Herbert). Action of Hydrogen on Amorphous Phosphorus . ii, 348
Young (George). Action of Hydrogen on Amorphous Phosphorus . ii, 348
Lieben (Adolf). Reduction of Carbonic Anhydride at Ordinary Temperatures . . . . ii, 348
Evans (Reginald C.) and Cecil H. Desch. Sodium Hydrogen Sulphide . . . . ii, 349
Seyewetz (Alphonse) and G. Chicandard. Sodium Thiosulphate in Photography . . . . ii, 349
Bogorodski (A.). Compounds of Lithium Bromide and Chloride with $3H_2O$ . . . . ii, 350
Bogorodski (A.). Double Compound of Lithium and Lead Iodide . ii, 350
Potilitzin (Alexei L.). Solubility of Anhydrous Calcium Sulphate . ii, 350
Duboin (André). Magnesium Fluorides and Silicates . . . . ii, 351
Le Chatelier (Henri L.). Alloys of Definite Composition . . . ii, 351
Schützenberger (Paul). Cerite Metals. . . . . ii, 352
Brauner (Bohuslav). Cerium . . . . ii, 352
Schlumberger (Ernest). Aluminium Compounds . . . . . ii, 353
Koninck (Lucien L. de). Properties of Nickel and Cobalt Salts . . ii, 355
Krüss (Gerhard) and Oskar Ungar. Dichromates of the Heavy Metals. . . . . ii, 355
Seubert (Karl) and William Pollard. Atomic Weight of Molybdenum . . . . ii, 356
Palmer (Chase). Chromates of the Rare Earths. Chromates of Thorium . . . . ii, 357
Pigeon Léon. Platinous Chloride and its Compounds . . . . ii, 357
Hoitsema (C.). Absorption of Hydrogen by Palladium . . . . ii, 388

PAGE

Moissan (Henri). Argon and Fluorine . . . ii, 388
Emich (Friedrich). Combustion in Nitrogen . . . ii, 388
Ferrand (L.). Thiohypophosphates . . . ii, 389
Beketoff (Nicolai N.) and Scherbatscheff. New Method of preparing Alkali Metals . . . ii, 389
Guntz (Antoine). Acid Fluorides of Potassium and Silver . . . ii, 389
Roques (Ferdinand). An Alcoholate of Calcium Bromide . . . ii, 390
Mylius (Franz) and Otto Fromm. Purification of Zinc . . . ii, 390
Roessler (Friedrich). Synthesis of Minerals and Analogous Metallic Compounds by Crystallisation from Molten Metals . . . ii, 390
Granger (A.). Action of Halogen Compounds of Phosphorus on Copper . . . ii, 392
Le Chatelier (Henri L.). Copper-aluminium Alloys . . . ii, 392
Arctowski (Henryk). Hydrolysis of Aqueous Solutions of Mercuric Chloride . . . ii, 393
Schützenberger (Paul). Cerite Earths. . . . ii, 393
Cohen (Julius B.) and Reginald Ormandy. Amalgamated Aluminium as a Reducing Agent . . . ii, 394
Lepierre (Charles). Manganese Compounds . . . ii, 394
Seubert (Karl) and Karl Gaab. Action of Ferric Chloride on Metallic Iodides . . . ii, 395
Arctowski (Henryk). Volatility of Chromic Anhydride . . . ii, 396
Ehrenfeld (Charles H.). Tungsten and Molybdenum and their Trioxides . . . ii, 396
Nordenskiold. New Source of Uranium . . . ii, 398
Pratt (J. H.). Double Halogen Salts of Caesium, Rubidium, Sodium, and Lithium with Thallium . . . ii, 398
Long (J. H.). Phenomena observed in the Precipitation of Antimony from Solutions of Tartar Emetic. . . . ii, 399
Klason (Peter). Constitution of the Platinum Bases . . . ii, 400
Clowes (Frank). Composition of Atmospheres that Extinguish Flame . ii, 443
Kreider (D. Albert). Preparation of Perchloric Acid and its Use in the Estimation of Potassium . . . ii, 444
Rayleigh (Lord). Density of Nitrogen . . . . ii, 444
Sabatier (Paul) and J. B. Senderens. Reduction of Nitric Oxide by Moist Iron or Zinc . . . ii, 445
Schwarz (Fritz). New Polyphosphoric acid, $H_5P_3O_{10}$, and its Salts . ii, 445
Vigouroux. Reduction of Silica by Aluminium . . . ii, 447
Přiwoznik (Ed.). Remarkable Change of Structure in Glass when heated ii, 447
Fileti (Michele). Molecular Weight of Mercurous Chloride . . ii, 447
Dennis (L. M.). Crystalline Aluminium Chloride . . . . ii, 447
Lorenz (Richard). Preparation of Stannic Bromide . . . ii, 448
Lorenz (Richard). The two Modifications of Stannic Acid . . . ii, 448
Schutzenberger (Paul). Cerite Earths . . . ii, 448
Wells (Horace L.). Iodine Compounds of Lead with Excess of Iodine ii, 449
Lodin (Arthur). Reactions of Lead Sulphide . . . ii, 450
Thomas (Vincent). Action of Nitric Peroxide on Antimony Salts . ii, 450
Werner (Alfred) and A. Klein. Salts of Amidochromic acid . . ii, 450
Lovén (Joh. M.). Conductivity of Permanganic acid . . . ii, 451
Hofmann (Karl A.) and O. F. Wiede. Nitroso-compounds of Iron . ii, 451
Mond (Ludwig), William Ramsay and John Shields. Occlusion of Oxygen and Hydrogen by Platinum Black . . . . ii, 492
Besson (J. Adolphe). Properties of Ozone and of Oxygen in Presence of Sunlight. . . . ii, 493
Holleman (Arnold F.). Spontaneous Decomposition of Thiosulphuric acid . . . ii, 493
Clowes (Frank). Composition of Extinctive Atmospheres produced by Flames . . . ii, 494
Berthelot (Marcellin). Combination of Nitrogen with Carbon and Sulphur . . . ii, 495

PAGE
SABATIER (PAUL) and J. B. SENDERENS. Reduction of Nitrous Oxide by Metals in Presence of Water . . . . ii, 495
THOMAS (V.). Action of Nitric Oxide on Metallic Chlorides . . . ii, 495
ILOSVAY DE NAGY ILOSVA (LUDWIG). Mutual Behaviour of Hydrogen Peroxide and Nitrous acid in very Dilute Solutions . . . . ii, 496
BRUYN (CORNELIUS A. LOBRY DE). Hydrazine Hydrate . . . . ii, 496
BRUYN (CORNELIUS A. LOBRY DE). Preparation of Hydrazine Hydrate . ii, 497
MOISSAN (HENRI). Reduction of Silica by Carbon . . . . . ii, 497
VILLARD (P.) and R. JARRY. Solid Carbonic Anhydride . . . . ii, 497
RAMSAY (WILLIAM). Gas showing the Spectrum of Helium, the reputed cause of one of the lines of the Coronal Spectrum . . . . ii, 498
RAMSAY (WILLIAM). Helium, a Gaseous Constituent of certain Minerals . . . . ii, 498
CLÈVE (PER T.). Density of Helium . . . . ii, 498
BERTHELOT (MARCELLIN). Compounds of Argon . . . . . ii, 498
WERNER (ALFRED). Constitution of Inorganic Compounds . . . ii, 499
KURNAKOFF (NICOLAI). Constitution of Metallic Bases . . . . ii, 499
FORCRAND (ROBERT DE). Sodamide . . . . ii, 499
EKKER (E. H.). Sodium Hyposulphite . . . . ii, 500
VENATOR (WILHELM). Recovery of Silver from Solutions . . . ii, 500
TASSILLY. Basic Halogen Salts of the Alkaline Earths . . . . ii, 500
RECOURA (ALBERT). Molecular Changes in Chromium Hydroxide . . ii, 501
MOISSAN (HENRI). Molybdenum . . . . ii, 501
HALLOPEAU (L. A.). Ammonium Sodium Hydrogen Tungstates . . ii, 503
HALLOPEAU (L. A.). Paratungstic Acid . . . . ii, 503
JOLY (ALEXANDRE) and ÉMILE LEIDIÉ. Action of Heat on Iridium Potassium Nitrites . . . . ii, 503

Mineralogical Chemistry.

HOFFMANN (G. C.). Native Iron . . . . ii, 20
ALEXÉEFF (W.). Mineral Wax from Kaluga . . . . ii, 20
DUMBLE (E. J.). Grahamite from Texas . . . . ii, 20
LOCZKA (J.). Chemical Constitution of Iron Pyrites . . . . ii, 20
KRENNER (J. A.). Andorite, a new Hungarian Silver Ore . . . ii, 21
DOSS (B.). Artificial Preparation of Anatase and Rutile . . . ii, 21
ULKE (T.). New Tin Mineral from the Black Hills . . . . . ii, 21
WALLER (E.) and A. J. MOSES. Nickel Arsenide . . . . . . ii, 21
JANNASCH (P.) and J. LOCKE. Apatite in a Laminated Graphite from Ceylon . . . . ii, 22
SJÖGREN (H.). Svabite and Adelite . . . . ii, 22
PRIOR (G. T.). Fergusonite from Ceylon . . . . ii, 22
WIIK (F. J.). Crystallochemical Theory of the Silicates . . . . ii, 22
HINMAN (B. C.). Orthoclase from Canada . . . . ii, 23
FLINK (G.). Neptunite, Epidymite, Katapleite, and Ægirine from Greenland . . . . ii, 23
DOELTER (C.). Dimorphous Minerals . . . . ii, 49
GORGEU (A.). Natural Oxides of Manganese . . . . . . ii, 50
TRAUBE (H.). Chromite in Lower Silesia . . . . ii, 50
PFAFF (F. W.). Formation of Magnesite and Dolomite . . . . ii, 50
TRAUBE (H.). Davyn . . . . ii, 50
RAMMELSBERG (C.). Chemical Nature of Staurolite . . . . . ii, 51
BONNEY (T. G.) and Miss C. A. RAISIN. Rocks and Minerals from the Karakoram Himalayas . . . . ii, 51
NATTERER (K.). Water and Sea-bottom Deposits from the Eastern Mediterranean . . . . ii, 51
STAATS (G.). Fresh Discovery of Gypsum Crystals . . . . . ii, 76
IGELSTRÖM (L. J.). Lindesite and Pyrrhoarsenite . . . . . ii, 76
PECKHAM (S. F.). Origin of Bitumens . . . . ii, 115

PAGE

Mallard (E.). Boleite, Cumengeite, and Percylite . . . . . ii, 115
Bodländer (G.). Composition of Polybasite . . . . . . ii, 115
Franco (P.). Aphthalose from Vesuvius . . . . ii, 115
Costa-Sena (J. A. da). Actinolite from Ouro-Preto, Brazil . . . ii, 116
Donald (J. T.). Asbestos and some Associated Minerals . . . ii, 116
Donald (J. T.). Scolecite from Canada . . . . ii, 116
Coleman (A. P.). Antholite from Elzevir, Colorado . . . . ii, 116
Moore (T.). Chocolate Nickel Ores of New Caledonia . . . . ii, 117
Retgers (J. W.). Mineralogical and Chemical Composition of the Sand of the Dunes of Holland . . . . ii, 117
Duparc (L.) and L. Mrazec. Serpentine of the Binnenthal . . . ii, 117
Hovey (E. O.). The Cherts of Missouri . . . . ii, 118
Nuricsan (J.). The Torda Brine Springs . . . . ii, 118
Lengyel (B. v.). The Kolop Sulphur Spring . . . . . . ii, 118
Baumhauer (Heinrich). Dufrenoysite from the Binnenthal . . . ii, 171
Stelzner (Alfred W.). Zinckenite from Oruro, in Bolivia . . . ii, 171
Vogt (J. H. L.). Iron Nickel Pyrites from Norway. . . . . ii, 171
Lemoine (A.). Free Alkaline Earths in Rocks containing Carbonates . ii, 171
Kosmann (K.). Kämmererite from Tampadel, in Silesia. . . . ii, 172
Milch (Ludwig). New Arsenate from Laurion . . . . . . ii, 172
Vrba (Carl). Phenacite from Ober-neusattel . . . . . . ii, 172
Vrba (Carl). Beryl from Pisek . . . . ii, 173
Tschirch (Alexander) and E. Aweng. Succinite (Amber) . . . ii, 275
Kohlmann (W.). Cassiterite . . . . ii, 275
Morozewicz (J.). Artificial Spinel and Corundum . . . . . ii, 275
Lagorio (Alexander E.). Pyrogenetic Corundum . . . . . ii, 276
Bücking (Hugo). Sulfoborite . . . . ii, 276
Hallberg (Gustaf). Apophyllite from Gräugesberg . . . . ii, 276
Katzer (Friedrich). Tourmaline, Gypsum and other Minerals from Bohemia . . . . ii, 277
Hobbs (William H.). Vulcanite, a New Rock . . . . . ii, 277
Nitze (H. B. C.). Monazite from North Carolina . . . . . ii, 319
Jannasch (Paul) and P. Weingarten. Chemical Composition and Constitution of Vesuvians . . . . ii, 319
Derby (Orville A.). Cañon Diablo Meteorite . . . . . . ii, 319
Ward (Henry A.). Plymouth Meteorite . . . . ii, 320
Thugutt (Stanislaus J.). Aluminosilicates . . . . . . ii, 358
Sestini (Fausto). Italian Graphites . . . . ii, 400
Bergeat (Alfred). Genetic Relations of Rutile, Ilmenite, and Sphene . ii, 400
Bourgeois (Léon) and Hermann Traube. Artificial Dolomite . . ii, 401
Nordenskjöld (Gustaf). Microlite, Parisite, and Elpidite from Greenland . . . . ii, 401
Jannettaz (Eduard). Analysis of Pyreneite . . . . ii, 401
Lindström (Gustaf). Elpidite, a New Mineral from Greenland . . ii, 401
Sjöström (O. A.). Neptunite . . . . ii, 402
Laspeyres (E. A. Hugo) and E. Kaiser. Meteoric Iron of Verchne-Udinsk . . . . ii, 402
Laspeyres (E. A. Hugo) and E. Kaiser. Silicates of the Netschaëvo (Tula) Meteorite . . . . ii, 402
Sestini (Fausto). Graphitite from Monte Pisano . . . . . ii, 504
Schimpff (W.). Sylvanite from Stassfurt . . . . ii, 504
Marsh (C. W.). Copper Iodide (Marshite) from Broken Hill, N.S.W. . ii, 504
Foullon (Heinrich v.). Cadmiferous blende from Mies: Rhodochrosite from Asia Minor . . . . ii, 505
Igelström (Lars J.). Thallium and Molybdenum in Hæmatite . . ii, 505
Fletcher (Lazarus). Baddeleyite (native zirconia) . . . . ii, 595
Arzruni (Andreas) and Konstantin Thaddéeff. Celestin from Giershagen, Westphalia . . . . ii, 505
Busz (Karl H. E. G.). Kamarezite . . . . ii, 506
Church (Arthur H.). A Basic Ferric Sulphate . . . . . ii, 506

PAGE
Prior (George T.) and Leonard J. Spencer. Augelite . . . . ii, 507
Church (Arthur H.). Analyses of some Arsenates and Phosphates . ii, 507
Hussak (Eugen) and George T. Prior. Lewisite and Zirkelite from Brazil . . . . ii, 508
Holmquist (P. L.). Pyrochlore from Alnö, Sweden . . . . ii, 509
Dick (Allan B.). Geikielite . . . . ii, 509
Arzruni (Andreas). Nephrite from Kuen-Lun . . . . . ii, 510
Eakins (L. G.) and Henry N. Stokes. Analyses of Heulandite and Smithsonite . . . . ii, 510
Melville (William H.). Analyses of Natrolite, Tourmaline, Spessarite, Bismuthinite and Felspar . . . . ii, 510
Weibull (Mats). Composition of Idocrase . . . . . . ii, 511
Sollas (William J.). Zinnwaldite from Mourne Mountains, Co. Down ii, 512
Eakle (Arthur S.) and Wilhelm Muthmann. So-called Schneebergite ii, 512
Heddle (M. Forster) and J. Stuart Thomson. Delessite from Cantyre . . . . ii, 512
Palache (Charles). Crossite, a New Soda Amphibole . . . . ii, 513
Sjögren (S. A. Hjalmar). Urbanite, a New Pyroxene . . . . ii, 513
Foullon (Heinrich v.). Analyses of Nickel-Silicate Ores . . . ii, 514
Sollas (William J.). Garnet Hornfels, from Co. Dublin . . . ii, 514
Sollas (William J.). The Leinster Granites . . . . . ii, 515
Natterer (Konrad). Water of the Sea of Marmora . . . . ii, 515

Physiological Chemistry.

Jaksch (R. v.). Amount of Nitrogen in Red Blood Crystals in Health and Disease. . . . . ii, 24
Biernacki (E.). The Blood in Anæmia . . . . ii, 24
Schenk (F.). Sugar in the Blood after Bleeding . . . . . ii, 24
Smith (W. J.). Formation of Sulphuric Acid in the Organism . . ii, 25
Cohn (R.). The Leucine of the Pancreatic Fermentation . . . ii, 25
Robitschek (W.). Peptone in Urine . . . . ii, 25
Nencki (M.). Behaviour of the Aromatic Hydroxyketones in the Animal Organism . . . . ii, 25
Hill (L.). Simple Form of Gas Pump . . . . ii, 51
Stohmann (F.). Heat Value of Nutritive Substances . . . . ii, 51
Pembrey (M. S.), M. H. Gordon, and R. Warren. Heat Production in the Chick before and after Hatching . . . . ii, 51
Lilienfeld (L.). Blood Coagulation . . . . ii, 52
Röhmann (F.). Glucase . . . . ii, 52
Weiske (E.). Action of Calcium and other Salts on the Animal Organism . . . . ii, 53
Mallory (F. B.). Calcareous Concretions in the Brain . . . . ii, 53
Croockewit (J. M.). Salivary Glands of the Leech . . . . ii, 53
Krüger (F.) and W. Lenz. Calcium in the Liver Cells of the Ox . . ii, 53
Krüger (F.), F. Szymkiewicz, L. v. Lingen, and H. Walter. Sulphur and Phosphorus in the Hepatic and Splenic Cells at Different Ages . . . . ii, 54
Wroblewski (A.). Caseïn of Human Milk . . . . . . ii, 54
Moraczewski (W.). Phosphorus in Digestion Products of Caseïn . . ii, 54
Neumeister (R.). Egg-shells of Echidna and other Vertebrates . . ii, 54
Lieblein (V.). Acidity of Urine . . . . ii, 55
Eiger (J.). Ethereal Hydrogen Sulphates in Urine . . . . ii, 55
Garrod (A. E.). Hæmatoporphyrin in Normal Urine . . . . ii, 55
Garrod (A. E.). Pigmentation of Uric Acid Crystals deposited from Urine . . . . ii, 55
Rake (B.). Percentage of Iron in the Urine in Ankylostomiasis . . ii, 56
Fawcett (J.). Piperazine as a Solvent of Uric Acid Stones in Urine . ii, 56
Cohn (R.). Physiological Properties of certain Pyridine, Naphthalene, and Quinoline Derivatives . . . . ii, 56

PAGE
Pickering (J. W.). Action of Drugs on the Heart of Daphnia . . ii, 57
Brandl (J.). Pharmacological Investigation of Manaca Roots . . ii, 57
Harley (V.). Influence of Intravenous Injection of Dextrose on the Gases of the Blood . . . . ii, 76
Gillespie (A. L.). Contents of the Healthy Stomach . . . . ii, 77
Gillespie (A. L.). Analysis of Gastric Contents . . . . . ii, 77
Gillespie (A. L.). Action of Acids and Alkalis on the Gastric Secretion ii, 77
Gillespie (A. L.). Gastric Digestion of Proteïds . . . . . ii, 77
Laas (R.). Influence of Fats on the Assimilation of Proteïds . . . ii, 78
Munk (I.). Metabolism . . . . ii, 78
Wright (A. E.). Influence of Carbonic Anhydride and Oxygen on Blood Coagulation . . . . ii, 78
Bruce (D.). Disappearance of Leucocytes from Blood after Peptone Injection . . . . ii, 79
Brunton (T. L.) and S. Delépine. Changes in Liver Cells . . . ii, 79
Grützner (P.). Chemical Stimulation of Sensory Nerves . . . ii, 79
Weinland (G.). Chemical Stimulation of Ciliated Epithelium . . ii, 80
Peters (R.). Rennet and Similar Ferments . . . . . . ii, 80
Vaudin (L.). Colostrum of the Cow . . . . ii, 81
Gillespie (A. L.). Albumoses in Serous Effusions . . . . ii, 81
Abel (J. J.). Ethylic Sulphide in Dog's Urine . . . . . ii, 81
Baisch (K.). Carbohydrates of Normal Urine . . . . . ii, 82
Boyd (F. D.). Albuminuria . . . . ii, 82
Gillespie (A. L.). Hæmoglobinuria . . . . ii, 82
Ogden (H. V.). Alcaptonuria . . . . ii, 83
Loewy (A.). Respiratory Exchanges . . . . ii, 119
Loewy (A.) and N. Zuntz. New Theory of Respiration . . ii, 119
Salkowski (E.) and M. Hahn. Behaviour of the Phosphorus of Caseïn in Peptic Digestion . . . . ii, 119
Weiske (H.). Amount and Composition of the Contents of the Stomach and Intestine of Rabbits at Different Periods of Feeding . . . ii, 120
Norden (v.) and K. Belgardt. Assimilation of Lime in the Body during Disease . . . . ii, 120
Weiske (H.). Addition of Calcium Phosphate to Food . . . . ii, 121
Lehmann (C.). Alkalinity of the Blood . . . . ii, 121
Loewy (A.). Alkalinity of the Blood . . . . ii, 121
Loewy (A.) and N. Zuntz. Alkalinity of Fresh Blood . . . . ii, 121
Lackschewitz (T.). Estimation of Blood Corpuscles . . . . ii, 122
Harris (D. F.). Coagulation of Milk . . . . ii, 122
Vaudin (L.). Citric acid and Calcium Phosphate in Milk . . . ii, 122
Wendelstadt (H.) and L. Bleibtreu. Human Blood in Disease . . ii, 123
Matthes (M.). Leucaemic Blood . . . . ii, 123
Pictet (R.). Frigotherapy . . . . ii, 123
Lewin (L.). Arrow Poisons . . . . ii, 123
Neumann (J.). Effect of Calcium Phosphate and Carbonate on increase of live weight . . . . ii, 173
Cohnstein (Wilhelm). Action of Intravenous Injection of Sodium Chloride on the composition of Blood and Lymph . . . . ii, 173
Vay (Franz). Ferratin and Iron in the Liver. . . . . . . ii, 173
Griffiths (Arthur B.). Red Pigment of *Diemyctylus Viridescens* . ii, 174
Bokorny (Theodor). Action of Dilute Alkalis on Lower Animals and Plants . . . . ii, 174
Hoppe-Seyler (Felix) and Trasaburo Araki. Rotatory Action of Lactates . . . . ii, 174
Hill (Leonard) and D. N. Nabarro. Blood Gases of Brain and Muscle in Rest and Activity . . . . ii, 231
Tissot (J.). Gaseous Exchange in Isolated Muscle . . . . . . ii, 231
Pembrey (Marcus S.). Regulation of Heat Production . . . . ii, 232
Lapicque (Louis) and Ch. Marette. Minimum amount of Nitrogen required by Human Beings . . . . . . ii, 232

PAGE
Klug (Ferdinand). Peptic Digestion . . . . ii, 232
Nencki (Marcellus). Pancreatic Digestive Products of Albumin . . ii, 233
Kaufmann (Maurice). Glycogen in the Blood . . . . . ii, 233
Seegen (Josef). Sugar and Muscular Work . . . . . . ii, 233
Röhmann (Franz) and Wilhelm Spitzer. Oxidising Action of Animal Tissue . . . . ii, 234
Arthus (Maurice). Fibrinogen and Fibrin . . . . . . ii, 234
Hayem (Georges). Fibrinogen and Fibrin . . . . . . ii, 234
Schäfer (Edward A.). Coagulation of Fibrinogen . . . . ii, 235
Oliver (George) and Edward A. Schäfer. Physiological Action of Extract of the Suprarenal Capsules . . . . ii, 235
Moore (B.). The Physiologically Active Substance Occurring in the Suprarenal Gland . . . . ii, 236
Nabarro (D. N.). Proteïds of Suprarenal Capsules . . . . ii, 236
Kaufmann (Maurice). Urea in Arterial and Venous Blood . . . ii, 236
Pasqualis (Giusto). Absorption and Elimination of Glycerophosphoric acid . . . . ii, 237
Edwards (Arthur). Saturation of Normal Urine with Neutral Salts . ii, 237
Laguardia (P.). Toxicological Investigation of Potassium Silicate . ii, 237
Lang (S.). Physiological Action of Acetonitrile and its Homologues . ii, 238
Pascheles (W.). Change of Cyanogen Compounds in the Body . . ii, 238
Pickering (John W.). Physiological Action of Chlorocaffeïne and Cyanocaffeïne . . . . ii, 238
Ringer (Sydney) and Arthur G. Phear. Influence of Pure Saline Media on Tadpoles . . . . ii, 239
Ringer (Sydney) and Arthur G. Phear. Influence of Saline Media on Tubifex Rivulorum . . . . ii, 239
Pictet (Raoul). Radiation at Low Temperatures and its Employment for Therapeutic purposes . . . . ii, 277
Lépine (Raphael). The Glycolytic Ferment . . . . . . ii, 277
Sebelein (John). Digestion of Pseudonuclein from Casein . . . ii, 278
Weiske (Hugo). Digestibility of Pentosans . . . . . . ii, 278
Manassee (Paul). Phosphorus and Sugar-yielding Constituents of Liver and Suprarenal Bodies . . . . ii, 278
Bethe (Albrecht). The Silvery Substance in the Skin of *Alburnus lucidus* . . . . ii, 279
Chatin (G. Adolphe) and Achille Muntz. Oyster Shells . . . ii, 279
Freund (Ernst) and Gustav Toepfer. Acidity of Urine . . . ii, 279
Stein (V.). Effect on Butter of Feeding with Sesame and Cotton Cake . ii, 280
Koehne (Fr.). Behaviour of Acid Imides in the Animal Organism . ii, 280
Moraczewski (Waclaw v.). The Blood in Cancer . . . . ii, 280
Zeynek (Richard v.). The Contents of two Lymph Cysts . . . ii, 280
Bohland (Karl). Levulose and Diabetes . . . . . . ii, 281
Weintraud (W.). Excretion of Acetone, Diacetic acid, and β-Hydroxybutyric acid in Diabetes . . . . ii, 281
Harley (Vaughan). Absorption of Fat . . . . ii, 320
Leathes (J. B.) and Ernest H. Starling. Absorption of Salt Solutions from the Pleural Cavities . . . . ii, 321
Klemptner (Max). Action of Copper on the Animal Organism . . ii, 321
Funaro (Angiolo). Poisoning by Barium Salts . . . . . ii, 322
Matignon (Camille). Heat Value of Proteïds in the Organism . . ii, 359
Voit (Erwin) and Alexander Korkunoff. Nitrogenous Metabolism . ii, 359
Pick (Friedel). The Liver and Metabolism of Carbohydrates . . ii, 360
Cremer (Max). Sugar and Cells . . . . ii, 360
Spitzer (Wilhelm). Glycolysis in Blood and Tissues . . . . ii, 361
Nencki (Marcellus). Thiocyanic acid in the Juices of the Stomach . ii, 361
Mitjukoff (Katharina). Paramucin . . . . ii, 361
Kühne (Willie). Visual Purple . . . . ii, 361
Cohnstein (Wilhelm). Action of Intravenous Injection of Sodium Chloride Solution on the Composition of the Blood . . . . ii, 362

PAGE
JEROME (WILLIAM J. S.). Abnormal Excretion of Sulphur in a Dog . ii, 362
KRAMM (WILLIAM). Physiological Action of Hydrohydrastinium Hydrochloride . . . . ii, 362
WROBLEWSKI (AUGUSTIN). Action of Thiocyanic acid on Gastric Ferments . . . . ii, 403
PAUTZ (WALTHER) and J. VOGEL. Action of the Mucous Membrane of the Stomach and Intestines on some Bioses and on Raffinose . . ii, 403
HAMBURGER (CARL). Comparison of the Ferment Actions of Saliva, Pancreatic Juice, Intestinal Juice, and Blood on Starch Paste . . ii, 403
LINDSEY and HOLLAND. Digestibility of Pentosans. . . . . ii, 404
KAYSER (R.). Relation of Fat and Carbohydrates to the Decomposition of Albumin in the Human Body . . . . ii, 404
MIURA (K.). Does Inulin lead to the Formation of Glycogen in Vegetable Feeders . . . . ii, 404
MIURA (K.). Inversion of Cane Sugar in the Small Intestine . . . ii, 405
HILL (LEONARD) and D. N. NABARRO. Exchange of Blood Gases in Brain and Muscle . . . . ii, 405
MIURA (K.). Grape Sugar in Blood. . . . . ii, 405
SCHÄFER (EDWARD A.) and GEORGE OLIVER. Physiological Action of Extract of Suprarenal Capsules . . . . ii, 405
SCHÄFER (EDWARD A.) and GEORGE OLIVER. Physiological Action of Extract of Pituitary Body . . . . ii, 405
REID (E. WAYMOUTH). Heat Production in Glands . . . . ii, 405
KÜLZ (EDUARD). Gases of Human Milk . . . . ii, 405
KÜLZ (C.). Paralactic Acid in Normal Pericardial Fluid. . . . ii, 405
PAUTZ (WALTHER). Metabolism in Diabetes . . . . . . ii, 406
MIURA (K.). Alimentary Glycosuria . . . . ii, 406
KÜLZ (EDUARD) and J. VOGEL. Pentoses in Diabetic Urine . . . ii, 406
LAFON (Ph.). Apparent Presence of Sugar in the Urine of Persons taking Sulphonal. . . . . ii, 406
LAPICQUE (LOUIS). Iron in Urine . . . . ii, 407
BECKER (ERNST) and EMILIO PARLATO. Acetonuria . . . . ii, 407
HALDANE (JOHN S.). Physiological Action of Carbonic Oxide . . . ii, 407
PASQUALI (ADALBERTO). Toxicological Properties of Hydroxylamine . ii, 407
PEMBREY (MARCUS S.). The Output of Carbonic Anhydride, and Temperature . . . . ii, 452
PEMBREY (MARCUS S.) and W. HALE WHITE. Heat Regulation in Hybernating Animals . . . . ii, 452
LOCKE (F. S.). An Ideal Circulating Fluid for the Isolated Frog's Heart ii, 452
GAY (PAUL). Comparative Digestibility of Sugar Beet, Mangel Wurzel and Distillery Roots . . . . ii, 452
HARRIS (VINCENT D.). Mycological Processes in the Intestines . . ii, 453
BÖTTCHER (O.). Feeding with Grain . . . . ii, 453
HARLEY (VAUGHAN). Absorption and Metabolism in the Obstruction of the Pancreatic Duct . . . . ii, 454
PICKERING (JOHN W.) and WILLIAM D. HALLIBURTON. Synthesised Colloïds and Coagulation . . . . ii, 454
MARINO-ZUCO (FRANCESCO) and C. MARTINI. Neurine in Blood . . ii, 454
HALLIBURTON (WILLIAM D.) and P. C. COLLS. Proteoses in Serous Effusions . . . . ii, 455
OECHSNER DE CONINCK (WILLIAM). Elimination of Magnesium Compounds in Cases of Rachitis . . . . ii, 455
LOCKE (F. S.). Action of Distilled Water on Animal Organisms . . ii, 455
HUNTER (WILLIAM). Physiological Action of Toluylenediamine . . ii, 456
THEZARD. Analysis of the Bone of a Mummy . . . . . ii, 456
CHATIN (G. ADOLPHE) and ACHILLE MÜNTZ. Phosphorus in Oysters . ii, 456
MACDONALD (GEORGE W.) and ALEXANDER M. KELLAS. Is Argon contained in Vegetable or Animal Substances? . . . . . . ii, 516
WRÓBLEWSKI (AUGUSTIN). Pepsin . . . . ii, 516
KÖHLER (A.), F. BARNSTEIN, and W. ZIELSTORFF. Kühn's Method of

PAGE

Artificial Digestion of Nitrogenous Food Constituents by Pepsin Solution . . . . ii, 516
WICKE (A.) and HUGO WEISKE. Influence of Fat and Starch on Metabolism . . . . ii, 516
ROOS (ERNST). Influence of the Thyroid Gland on Metabolism . . ii, 516
WEISKE (HUGO). Acid Fodder and its effect on the Organism . . ii, 517
MACALLUM (A. B.). Distribution of Assimilated Iron Compounds, other than Hæmoglobin and Hæmatin, in Animal and Vegetable Cells . ii, 518
HALLIBURTON (WILLIAM D.). Nucleo-Proteïds . . . . . . ii, 518
CHABRIÉ (P. CAMILLE). Chemical Phenomena of Ossification . . ii, 518
WEISKE (HUGO). Composition of the Bones, Teeth, &c., of Wild and Tame Rabbits . . . . ii, 519
SANDMEYER (W.). Paranucleïn in the Animal Organism . . . ii, 519
DAPPER (KARL). Uric Acid Excretion . . . . ii, 520
LIEBLEIN (VICTOR). Acidity of Urine . . . . ii, 520
WHITE (W. HALE). Use of Levulose in Diabetes . . . . . ii, 520
GRUBE (KARL). Levulose in Diabetes . . . . ii, 520

Chemistry of Vegetable Physiology and Agriculture.

ENGELMANN (T. W.). Separation of Oxygen by Cells containing Chromophyll . . . . ii, 26
BACH (A.). Hydrogen Peroxide in Green Plants . . . . . . ii, 26
HANSEN (A.). Formation of Substance in Sea Algæ. . . . . . ii, 26
KNY (L.). Physiological meaning of the Cyanic Colouring Matters . . ii, 27
ÉTARD (A.). Presence of several distinct Chlorophylls in the same Vegetable Species . . . . ii, 27
WEHMER (C.). Calcium Citrate in Plants . . . . ii, 27
BRÉAL (E.). Nutrition of Plants by Humus and Organic Substances . ii, 28
PATUREL (G.). Agricultural Value of various Natural Phosphates . . ii, 28
D'ARCY (R. F.) and W. B. HARDY. Bactericidal Action of Light and Air . . . . ii, 57
WESBROOK (F. F.). Effect of Sunlight on Tetanus Cultures . . . ii, 58
MACFAYDEN (A.) and F. R. BLAXALL. Thermophilic Bacteria . . ii, 58
LAWS (J. P.). Antiseptic Action of Phenyl-substituted Fatty Acids . ii, 58
KOCH (A.) and P. KOSSOWITSCH. Assimilation of Nitrogen by Algæ . ii, 58
KOSSOWITSCH (P.). Fixation of Free Nitrogen by Algæ . . . . ii, 59
RICHARD (P.). Assimilability of Potassium in Poor Sandy Soils by the Action of Nitrates . . . . ii, 60
SCHULTE (J.). Effect of Chlorides on Vegetation and on the Amount of Starch in Potatoes . . . . ii, 61
KRAUSS (C.) and A. STELLWAG. Effect of the Ripeness and of Manures on the Physical and Chemical Properties of Barley Meal . . . ii, 61
COHN (H.). Nutritive Value of Cocoa . . . . ii, 61
ILOSVAY DE NAGY ILOSVA (L.). Secondary Products containing Nitrogen formed during combustion in Air . . . . ii, 61
ONIMUS (E.). Dialysis of Beer Yeast . . . . ii, 83
TOLOMEI (G.). Nitrifying Ferment . . . . ii, 83
SCHULZE (E.). Glutamine in the Green Parts of Plants . . . . ii, 83
SCHULZE (E.). Crystalline Nitrogenous Compounds in Seedlings . . ii, 84
BERTHELOT and G. ANDRÉ. Vegetable Principles which Decompose with Liberation of Carbonic Anhydride . . . . ii, 124
PRIANISCHNIKOW (D.). Germinating Process in *Vicia sativa* . . . ii, 124
DEMOUSSY. Assimilation of Nitrates by Plants . . . . . . ii, 125
BALENTINE (W.). Foraging Power of some Agricultural Plants for Phosphoric acid . . . . ii, 126
ASSFAHL (E.). Nutrition of Green Plants by Glycerol . . . . ii, 126
PURJEWICZ (W.). Formation and Decomposition of Organic Acids in the Higher Plants . . . . ii, 126

PAGE
Ishii (J.). Mannan as a Reserve Material in the Seeds of *Diospyrus kaki* . . . ii, 128
Daikuhara (C.). Reserve Proteïn in Plants . . . ii, 128
Ishii (J.). Mucin in Plants . . . ii, 128
Giessler (R.). Localisation of Oxalic acid in Plants . . . ii, 129
Bauer (W.). Levulose from Dried Orange Peel . . . ii, 129
Lippmann (E. O. v.). Occurrence of Vanillin . . . ii, 129
Loew (O.) and M. Tsukamoto. Poisonous Action of Dicyanogen . . . ii, 129
Yabe (K.). Poisonous Action of the Hydroxy-derivatives of Benzene on Yeast and Bacteria . . . ii, 130
Yabe (K.). The Vegetable Cheese, Natto . . . ii, 130
Pagnoul. Saline Constituents of Potatoes and Oats . . . ii, 130
Stoklasa (J.). The Compounds of Phosphoric acid in Superphosphates soluble in Water . . . ii, 131
Dehérain (P. P.). Drainage from Cultivated Soils . . . ii, 133
Wypfel. Effect of Chlorides on the growth of Plants . . . ii, 175
Stahl (E.). Transpiration and Assimilation . . . ii, 175
Maquenne (Léon). Leaf Respiration . . . ii, 175
Palladin (Wladimir). Respiration of Green and Etiolated Leaves . . . ii, 176
Chalmot (Guillaume de). Pentosans in Plants . . . ii, 176
Weisberg (J.). Occurrence of Pentosans in Plants . . . ii, 177
Bourquelot (Emile E.). Methylic salicylate in Indigenous Plants . . . ii, 177
Spatzier (W.). Occurrence and Rôle of Myosin in Plants . . . ii, 178
Prove. Richness of Soil in Nitrogen after Cultivation of various Plants . ii, 178
Schulze (Bernhard). Analyses of Silesian Soils . . . ii, 178
Dehérain (Pierre P.). Experiments on Wheat and Barley at Grignon. ii, 179
Fischer (M.). Effect of Manure, Season, and Seed on the composition of Rye . . . ii, 179
Nilson (Lars F.). Manuring Experiments with various Phosphates and Nitrogenous Substances . . . ii, 180
Ehrich (E.). Varying Composition of Malt. Means of Regulating the Degree of Fermentation . . . ii, 181
Bach (A.). Detection of Hydrogen Peroxide in Green Plants . . . ii, 239
Peyrou (J.). Atmospheric Ozone . . . ii, 240
Uffelmann (C.) and A. Bömer. Chemical Composition of Kola Nuts . ii, 241
Andouard (Ambroise). Phosphate from Grand-Connétable . . . ii, 242
Iwanowsky (D.). Effect of Oxygen on Alcoholic Fermentation . . . ii, 282
Chudiakow (N. v.). Alcoholic Fermentation . . . ii, 282
Obermayer (Fritz) and Richard Kerry. Albuminous Fermentation . ii, 283
Winogradsky (Sergei). Assimilation of Free Atmospheric Nitrogen by Microbes . . . ii, 283
Berthelot (Marcellin) and Gustave André. Alumina in Plants . ii, 284
Stone (Winthrop E.). Carbohydrates of the Gum of *Acacia decurrens*. ii, 285
Wiechmann (F. G.). Bass Wood Oil . . . ii, 285
Bertrand (Gabriel). Sap of the Lac Tree . . . ii, 285
Lecomte (H.) and Alexandre Hébert. Moâbi Seeds . . . ii, 285
Tacke (Bruno). Peculiar Property of Phosphoric acid in Peaty Soil . ii, 285
Schloesing (J. J. Théophile). Loss of Nitrogen in Drainage Waters . ii, 286
Fischer (Emil) and Paul Lindner. Enzymes of *Schizosaccharomyces Octosporus* and *Saccharomyces Marxianus* . . . ii, 322
Koch (Alfred) and Hosaeus. Behaviour of Yeast towards Glycogen . ii, 322
Gilson (Eugène). Cell-Membrane of Fungi . . . ii, 323
Mielke (G.). Place of Tannins in Plant Metabolism . . . ii, 324
Werenskiold (F. H.) and E. Solberg. Hay analyses of Norwegian Grasses . . . ii, 324
Bourquelot (Emil E.). The Time of Trehalose Formation in Plants . ii, 362
Petit (Paul). Variations in the Sugars during the Germination of Barley . . . ii, 363
Stone (Winthrop E.) and Dumont Lotz. Sugar of the *Agave Americana* . . . ii, 363

PAGE
Schulze (Ernest), S. Frankfurt, and Ernst Winterstein. The Organic Bases of some Agricultural Seeds, Oil Cakes, Tubers, and of some Seedlings ii, 364
Romburgh (Pieter van). Essence of Roots of Polygala from Java ii, 364
Romburgh (Pieter van). Volatile Principles of Coca Leaves from Java ii, 365
Mayr (Heinrich). The Resin of German Pines ii, 365
Atterberg (Albert). Composition of Oat Plants ii, 365
Einecke (Albert). Composition of Different Kinds of Berries ii, 366
Massey (Cecil). Composition of Soils from South India ii, 366
Damseaux (A.). Effect of Sulphurous acid on Soil and its Produce ii, 366
Hilgard (Eugen W.) and Mejer E. Jaffa. Amount of Nitrogen in the Humus in Soils of Arid and Humid Regions ii, 367
Kühn (Julius). Utilisation of the Nitrogen of Farmyard Manure, and of Green Manure ii, 367
Boettinger (Carl). The Glucosazone from Sumach and from Vallonia. ii, 407
Grützner (Bruno). Crystalline Constituent of *Basanacantha Spinosa var. Ferox, Schum.* ii, 408
Zenetti (P.). Occurrence of Hesperidin in *Folia Bucco* ii, 408
Gilson (Eugène). Presence of Chitin in the Cellular Membrane of Mushrooms ii, 408
Brunner (Heinrich) and Ernest Chuard. Glyoxylic acid in Green Fruits ii, 409
Koch (F.). Mid-European Nut Galls and *Scrophularia Nodosa L.* ii, 409
Lyttkens (Aug.). Effect of Arsenic on Vegetation ii, 410
Bokorny (Thomas). Effect of Calcium and Magnesium on the Development of the Organised Structures of the Cell ii, 457
Roberts (Leslie). Physiology of the *Trichophytons* ii, 457
Mer (Émile). Action of Calcium and Potassium Salts on the Herbage of Meadows ii, 458
Zacharewicz (Ed.). Manuring Natural Meadows ii, 458
Dehérain (Pierre P.). Drainage from Cultivated Land ii, 458
Blackmann (F. Frost). Vegetable Assimilation and Respiration: The Carbonic Anhydride Exchanges of Plants ii, 520
Schloesing (Th. jun.). Germination of Seeds ii, 521
Pfeiffer (Theodor) and E. Franke. Utilisation of Elementary Nitrogen by Mustard ii, 521
Hiltner (Lorenz). Influence of the Root Nodules of *Alnus Glutinosa* on the Fixation of Nitrogen ii, 522
Mayer (Adolf). Composition of the Root Nodules of the Alder ii, 523
Schulze (Ernst) and S. Frankfurt. Cane Sugar in Plants ii, 523
Cross (Charles F.), Edward J. Bevan, and Claud Smith. Origin of Unsaturated Compounds in Plants ii, 524
Stoklasa (Julius). Chemical Investigations in Plant Pathology ii, 524
Behrens (J.). The Tobacco Plant ii, 524
Gerlach (Max). Behaviour of Phosphoric Acid, soluble in Water, towards the Absorbent Constituents of Soil ii, 524

Analytical Chemistry.

Gooch (F. A.) and J. Howland. Iodometric Estimation of Telluric Acid ii, 30
Noyes (W. A.) and E. D. Frohman. Volumetric Estimation of Phosphorus in Steel ii, 30
Jannasch (P.) and J. Locke. Analysis of Apatite in a Laminated Graphite from Ceylon ii, 31
Gooch (F. A.) and H. P. Moseley. Detection and Estimation of small quantities of Arsenic in Copper ii, 31

PAGE
Christomanos (A.). Apparatus for the Estimation of Carbonic Anhydride . . . ii, 31
Kratschmer (F.) and E. Wiener. Estimation of Carbonic Anhydride in the Air . . . ii, 32
Schiff (H.). Indirect methods of Analysis . . . ii, 32
Bomboletti (A.). Avoidance of error in Hydrotometric Analysis . . . ii, 32
Bödtker (E.). Estimation of Chlorine in Urine . . . ii, 62
Meineke (C.). Sodium Thiosulphate for Standardising Iodine Solutions . . . ii, 63
Johnson (F.). Estimation of Sulphur in Pyrites . . . ii, 63
Bujwid (O.). Indole as a Test for Nitrites . . . ii, 63
Aslanoglou (P. L.). Estimation of Carbonates and Caustic Alkalis in Mixtures . . . ii, 63
Seyler (C. A.). Estimation of Carbonates and Caustic Alkalis in Mixtures . . . ii, 64
Schottländer (P.). Triammonium Orthophosphate and the Detection of Manganese . . . ii, 64
Neumann (G.). Estimation of the Heavy Metals by Titration with Sodium Sulphide . . . ii, 64
Kutusow (L.). Colorimetric Estimation of Picric Acid in its Compounds with Organic Bases . . . ii, 64
Schiff (R.) and N. P. Tarugi. Thioacetic acid as a Substitute for Hydrogen Sulphide in Qualitative Analysis . . . ii, 84
Hundeshagen (F.). Applications of Alkalimetry and Acidimetry . . . ii, 84
Benedikt (R.) and H. Zikes. Estimation of small Quantities of Chlorine in Fats . . . ii, 85
Zay (C. E.). Estimation of Organic Nitrogen by Stock's Method . . . ii, 86
Monnier (D.) and H. Auriol. Volumetric Estimation of Nitric acid . . . ii, 86
Sestini (F.). Genuineness of Basic Slag . . . ii, 86
Koch (H.). Estimation of Carbon in Steel . . . ii, 86
Eyk (J. van). Sodium Cobalt Nitrite as a Reagent for Potassium . . . ii, 87
Hellich (A.). Assay of Nitre . . . ii, 87
François. Estimation of Mercury in Presence of Iodine . . . ii, 87
Riggs (R. B.). Qualitative Separation of Chromium from Iron and Aluminium . . . ii, 88
Ullmann (C.). Apparatus for the Assay of Pyrolusite by Bunsen's Process . . . ii, 88
Roberts (Miss C. F.). Standardising Potassium Permanganate . . . ii, 88
Ripper (M.). Estimation of Iron in the Ash of Vegetable or Animal Matter . . . ii, 89
Vortmann (G.). Electrolytic Separation of Iron and Cobalt from Zinc . . . ii, 89
Jannasch (P.). Separation of Arsenic, Tin, or Antimony from Lead, Copper, Silver, Cobalt, Nickel, &c. . . . ii, 89
Zega (A.). Action of Organic Matters on Potassium Permanganate . . . ii, 90
Riche (A.) and G. Halphen. Analysis of Petroleums . . . ii, 90
Klimont (J.). Assay of Ethereal Oils . . . ii, 91
Ashby (A.). Detection of Methylated Spirits in Tinctures, &c. . . . ii, 91
Grünhut (L.). Gravimetric Estimation of Sugar by means of Alkaline Copper Solutions . . . ii, 91
Gaud (F.). Gravimetric Estimation of Glucose . . . ii, 92
Allein and F. Gaud. Modification of the Copper Test for Glucose . . . ii, 92
Karcz (M.). Estimation of Crystallisable Sugar in Raw Sugars . . . ii, 93
Amthor (K.). Estimation of Cane Sugar in Beer Wort . . . ii, 93
Filsinger (F.). Estimation of Starch in Compressed Yeast . . . ii, 93
Schulze (E.). Estimation of Carbohydrates . . . ii, 94
Krüger (M.). Separation of Uric acid, Adenine, and Hypoxanthine . . . ii, 94
Krüger (M.) and C. Wulff. Estimation of Xanthine-like Substances in Urine . . . ii, 94
Schaffer (M.). Estimation of Acidity in Milk . . . ii, 94
Timpe (H.). Soxhlet's Aerometric Estimation of Fat in Milk . . . ii, 95

	PAGE
Bevan (E. J.). Loss of Total Solids in Milk on Keeping	ii, 95
Cantoni (L.) and L. Carcano. Periodic Estimation of Volatile Fatty Acids in the Butter produced during a Year	ii, 95
Bünte (C.). Modification of the Reichert-Meissl Butter Process	ii, 95
Schulze (E.). Estimation of Lecithin in Plants	ii, 96
Henriques (R.). Analysis of India-rubber Wares	ii, 96
Morse (H. N.) and T. L. Blalock. Instruments for the Graduation and Calibration of Volumetric Apparatus	ii, 134
Behrend (R.). Electrometric Analysis	ii, 134
Reinitzer (B.). Notes on Volumetric Analyses	ii, 134
Trey (H.). Sensitiveness of Zone Reactions and their Use in Testing for Acids	ii, 135
Lenoble (E.). Correction in the Determination of the Titre of a Liquid holding a Precipitate in Suspension: Application to Saccharimetry	ii, 135
Ulzer (F.) and A. Friedreich. Estimation of Chlorine in Commercial Iodine	ii, 136
Jolles (A.). Detection of Iodine in Urine	ii, 136
Koninck (L. L. de) and E. Nihoul. Estimation of Organic Sulphur	ii, 136
Mabery (C. F.). Estimation of Sulphur in Volatile Organic Compounds	ii, 136
Fresenius (R.). Detection of Traces of Metallic Sulphides in Precipitated Sulphur	ii, 137
Windisch (W.). Volumetric Estimation of Sulphuric acid	ii, 137
Haselhoff (E.). Estimation of Nitrogen in Guano	ii, 138
Barbera (A. G.). New Mercury Ureometer	ii, 138
Glaser (F.). Estimation of Phosphoric acid by the Citric acid Process	ii, 138
Wrampelmeyer (E.). Estimation of the Value of Phosphates insoluble in Water	ii, 139
Jensch (E.). Analysis of Zinc Ores	ii, 139
Thomälen (H.). Rüdorff's Process of Electrolysis	ii, 139
Oettel (F.). Electrolytic Estimation of Copper in Ammoniacal Solution	ii, 139
Vitali (D.). Indirect Volumetric Analyses by means of Sulphurous acid	ii, 140
Edwards (V.). Estimation of Iron and Aluminium in Phosphates	ii, 140
Drown (T. M.) and G. F. Eldridge. Volatility of Stannic Chloride	ii, 140
Fabre (C.), Garrigou, and Surre. Estimation of Alcohol in so-called Essential Oils	ii, 141
Muller (J. A.). Estimation of Mannitol by the Optical Method	ii, 141
Nihoul (E.). Estimation of Sugar by Fehling's Solution	ii, 142
Gaud (F.). Estimation of Glucose by means of Alkaline Copper Solutions	ii, 143
Heinebuch (A.). Analysis of Urine	ii, 143
Borntraeger (A.). Influence of Normal or Basic Lead Acetate on Invert Sugar	ii, 143
Munsche (A.). Estimation of Starch by Alcoholic Fermentation	ii, 144
Councler (C.). New Process for Estimating Furfuraldehyde and Pentosans	ii, 144
Goudoin (J.). Estimation of Thiocyanic acid	ii, 144
Weibull (M.). Analysis of Milk	ii, 145
Seyda and Woy. Detection of Margarine in Butter	ii, 145
Killing (C.). Testing Butter for Foreign Fats	ii, 145
Halphen (G.). Analysis of Lard	ii, 146
Filsinger (F.). Analysis of Linseed Oil	ii, 147
Morpurgo (G.). Analysis of Castor Oil	ii, 147
Maupy (L.). Detection of Castor Oil in Copaiba Balsam and in Croton Oil	ii, 147
Schaffer (M.). Application of Gas Analysis to Cheese Making	ii, 148
Lenz (Wilhelm). Difficulty in the Detection of Chlorine in Methylene Blue	ii, 182

PAGE
Lescœur (Henri). Chlorine in the Gastric Secretion . . . . ii, 182
Gantter (Fr.). Gasometric Method of Estimating Nitrogen in Nitrates. ii, 183
Kilgore (B. W.). Estimation of Phosphoric acid by titrating the Yellow Precipitate . . . . ii, 183
Segalle (R.). Volumetric Estimation of Phosphoric acid . . . ii, 184
Edwardes (Vincent). Estimation of Soluble Phosphate . . . ii, 184
Koningh (Leonard de). Estimation of Arsenic and Sulphur. . . ii, 184
Clennell (J. E.). Estimation of Alkali Hydroxides and Carbonates in the presence of Alkali Cyanides . . . . ii, 185
Chikashigé (Masumi). Decomposition of Sulphates by Ammonium Chloride . . . . ii, 185
Archbutt (Leonard). Analysis of Sodium Peroxide . . . . ii, 185
Stone (Winthrop E.) and F. C. Scheuch. Estimation of Calcium Oxide in Quicklime . . . . ii, 186
Warren (Henry N.). Analysis of Zinc and Copper Alloys . . . ii, 186
Keller (Harry F.). Analysis of American Refined Copper . . . ii, 186
Jedermann (Robert). Examination of Rose Oil for Geranium Oil . ii, 187
Bornträger (Arthur). Procedure in Fehling's Titration . . . ii, 187
König (Josef) and W. Karsch. Ratio of *d*-Glucose to Levulose in Sweet Wines and Honey. Use of this Ratio for Detecting Adulteration . ii, 188
Stone (Winthrop E.). Comparison of Methods for the Estimation of Starch. . . . . ii, 189
Aitken (A. P.). Estimation of Woody Fibre in Fodders. . . . ii, 189
Liverseege (John F.). Bell's Analyses of Genuine Milk . . . ii, 189
Kühn (M.). The Keeping of Milk for Analysis . . . . . . ii, 189
Evans (Thomas) and T. E. Beach. The Twitchell Method for Estimating Rosin in Soap . . . . ii, 190
Archbutt (Leonard). Gladding's Process for Estimating Resin in Soap . . . . ii, 190
Gonnermann (Max). Estimation of Glycocine . . . . . . ii, 190
Vanino (Ludwig). Tables for the Estimation of Urea by Riegler's Method . . . . ii, 190
Clarency (A.). Optical Method for Estimating Albumin and Uric Acid in Urine . . . . ii, 190
Henriques (Robert). Analysis of India-rubber . . . . . . ii, 191
Weber (Carl O.). Analysis of Rubber Goods. . . . . . . ii, 191
Lohnstein (Theodor). Densimetric Estimation of Proteïd . . . ii, 192
Schulze (Ernst). Analysis of Seeds . . . . ii, 192
Kippenger (Carl). Simple Apparatus for Gas Analysis . . . ii, 242
Lunge (George). Litmus and Methyl-orange as Indicators . . . ii, 242
Raikow (P. N.). Detection and Estimation of Chlorine in Presence of Iodine . . . . ii, 242
Gerlach and Süvern. Estimation of Nitrogen in Feeding Stuffs by Kjeldahl's Process . . . . ii, 243
Stanojewitsch (Duschan). Estimation of Nitrogen in Nitrocellulose . ii, 243
Neubauer (Hugo). Estimation of Nitrogen and Phosphoric acid . . ii, 243
Wagner (Paul). Estimation of Citrate-soluble Phosphoric acid in Basic Slag and Mineral Phosphates . . . . ii, 243
Glaser (Charles). Kalman and Meissel's Process for the Volumetric Estimation of Phosphoric acid in Superphosphates . . . . ii, 244
Edinger (Albert). Estimation of Sulphur and of Chlorine with Sodium Peroxide . . . . ii, 244
Spüller (Jos.) and S. Kalman. Estimation of Sulphur in Pig Iron and Steel . . . . ii, 244
Schweitzer (H.) and E. Lungwitz. New Process for Estimating Potassium . . . . ii, 245
Trubert (Albert). Estimation of Calcium and Magnesium Carbonates in Soils, Ashes, &c. . . . . ii, 245
Raikow (P. N.). Separation of Copper from Cadmium, Zinc, and Nickel ii, 246
Hess (W.). Estimation of Iron and Aluminium in Phosphates . . ii, 246

PAGE
JEAN (FERDINAND). Estimation of Iron and Aluminium in Phosphates . ii, 246
VILLIERS (A.). Qualitative Separation of Nickel and Cobalt . . . . ii, 247
WEIBULL (MATS). Analysis of Sour Milk . . . . ii, 247
NEGRI (G. DE) and GUIDO FABRIS. Oils . . . . ii, 247
LUNGE (GEORG). Universal Gas Volumeter . . . . ii, 287
BODLÄNDER (GUIDO). The Gasgravimeter . . . . ii, 287
BORNTRÄGER (ARTHUR). Potassium Hydrogen Tartrate as material for Standardising Alkalis . . . . ii, 289
WENSE (WILHELM). Estimation of Bromine in Presence of Chlorine . ii, 289
HUYSSE (A. C.). Colorimetric Estimation of hydrogen sulphide . . ii, 289
WHITEHEAD (CABELL). Estimation of Tellurium in Copper Bullion . ii, 289
DELÉPINE (MARCEL). Kjeldahl's Method and Platinochlorides . . ii, 290
KALMANN (WILHELM) and K. MEISSELS. Volumetric Estimation of the Soluble Phosphoric acid in Superphosphates . . . . . . ii, 290
SCHEIDING (FR.). Analytical Communications . . . . . . ii, 290
LUNGE (GEORG). Estimation of Sulphur in Pyrites. . . . . . ii, 291
SHIMER (PORTER W.) Estimation of Zinc . . . . ii, 291
SCHNEIDER (LEOPOLD). Chemical Investigation of Steel . . . . . ii, 292
HANDY (JAMES O.). Barium Hydroxide Solution in Steel Analysis . . ii, 292
SACHSSE (ROBERT) and ARTHUR BECKER. Estimation of Free Ferric Oxide in Soil . . . . ii, 293
MCELROY (K. P.). Estimation of Iron and Aluminium in Phosphates . ii, 293
CAMPBELL (EDWARD D.) and W. H. ANDREWS. Separation of Nickel from Iron . . . . ii, 293
CLARK (EDMUND). Estimation of Chromium in Chrome Ore . . . . ii, 294
OEHMICHEN (RICHARD). Assay of Alloys containing Gold, Silver, Zinc and Tin . . . . ii, 295
BACHMAN (IRVING A.). Improved Methods of Water Analysis . . ii, 295
POWER (FREDERICK B.) and CLEMENS KLEBER. Composition of American Peppermint Oil . . . . ii, 295
HERZIG (JOSEF) and HANS MEYER. Detection and Estimation of Alkylgroups attached to Nitrogen . . . . ii, 296
BORNTRAEGER (ARTHUR). Influence of the Lead Acetates on the Estimation of Invert Sugar . . . . ii, 296
WEBER (H. A.) and WILLIAM MCPHERSON. Estimation of Cane sugar in the presence of Commercial Glucose . . . . ii, 296
WEBER (H. A.) and WILLIAM MCPHERSON. Action of Acetic and Hydrochloric acids on Cane sugar . . . . ii, 297
BERG (ARMAND). Reaction of Hydroxy-carboxylic acids . . . . . ii, 297
BARTHE (LEONCE). Estimation of Salicylic acid and Salicylates . . ii, 297
THÖRNER (WILHELM). Gaseous Products in Milk . . . . . . ii, 298
FERNANDEZ-KRUG (P.) and WILHELM HAMPE. New Process for Estimating Fat in Milk . . . . ii, 298
BOETTINGER (CARL). Estimation of Fat in Milk . . . . . . ii, 299
STEIN (V.). Effect on Butter of Feeding with Sesame and Cotton Cakes. . . . . ii, 299
QUINQUAD (CH. EUGÈNE). Urea in the Blood . . . . . . ii, 299
DOUMER (EMMANUEL) and E. DERAUX. Solubility of Quinine in Alkalis. ii, 299
BARILLOT (ERNEST). Detection of Colchicine . . . . ii, 300
DASTRE (A.). Fibrinolysis . . . . ii, 300
LOHNSTEIN (THEODOR). Densimetric Estimation of Albumen . . . ii, 300
WARREN (HENRY N.). Nitrocellulose Filters . . . . ii, 325
BOORSMA (P. A.). Some Indicators . . . . ii, 325
ZULKOWSKI (KARL) and ENRICO PODA. New Process for Drying Hygroscopic Substances . . . . ii, 325
JANNASCH (PAUL) and P. WEINGARTEN. Estimation of Water in Silicates . . . . ii, 325
WALKER (JAMES) and JAMES HENDERSON. Estimation of Halogens in Organic Compounds . . . . ii, 326
LOHMANN (P.). Estimation of Chlorine in Wool Grease . . . . . ii, 326

PAGE
Benedikt (Rudolph). Estimation of Chlorine in Wool Grease . . ii, 326
Knobloch (J.). New Volumetric Methods . . . . ii, 326
Moreigne (Henri). Estimation of Sulphur in Urine . . . . ii, 327
Moreigne (Henri). Estimation of total Nitrogen in Urine . . . ii, 327
Bayrac (Pierre H.). Estimation of Total Nitrogen in Urine . . ii, 327
Garrigues (W. E.). The Gunning Method for the Estimation of Nitrogen in Fertilisers . . . . ii, 328
Kemp (George T.). Estimation of Nitrous Oxide . . . . . ii, 328
Lychenheim. Estimation of Phosphorus in Coal and Coke . . . ii, 328
Bénazet (P.). Estimation of Phosphorus in Iron . . . . . ii, 328
Langer (Julius). Volumetric Estimation of Officinal Phosphoric acid . ii, 329
Glücksmann (Carl). Volumetric Estimation of Officinal Phosphoric acid . . . . ii, 329
Kilgore (B. W.). Estimation of Phosphoric acid by the Molybdate Process . . . . ii, 329
Barillot (Ernest). Estimation of Arsenic in Organic Matter . . ii, 329
Foerster (Fritz). Estimation of Carbon in Iron . . . . . ii, 330
Jannasch (Paul). Decomposition of Silicates by Pure Lead Carbonate . ii, 330
Denigès (Georges). The Hydrobromic acid Test for Copper . . . ii, 330
Seubert (Karl) and William Pollard. Acidimetric Estimation of Molybdic acid . . . . ii, 331
Jannasch (Paul) and A. Röttgen. Quantitative Separation of Metals in Alkaline Solution with Hydrogen Peroxide . . . . . ii, 331
Jannasch (Paul) and E. v. Cloedt. Separation of Bismuth, Lead, and Manganese from Mercury by means of Hydrogen Peroxide . . ii, 332
Couvée (J. J.). Paradiazobenzenesulphonic acid as a Reagent in Water Analysis . . . . ii, 332
Denigès (Georges). Estimation of Thiophen in Benzene . . . ii, 332
Basset (Henry). Anthracene Testing . . . . ii, 332
Schimmel and Co. Quantitative Testing of Ethereal Oils . . . ii, 333
Linton (Laura A.). Technical Analysis of Asphalt . . . . ii, 333
Muller (Joseph A.). Estimation of Mannitol in Wines . . . ii, 334
Jaworowski (A.). Detection of Glucose . . . . ii, 334
Mann (F.) and Bernhard Tollens. Estimation of Glycuronic acid by its yield of Furfuraldehyde . . . . ii, 335
Gerard (Aimé). Estimation of Tannins . . . . ii, 335
Holde (D.). Sunflower Oil . . . . ii, 335
Baitandier (J. A.). Reactions of Chelidonine with Phenols . . . ii, 336
Glasenap (H. W.). Decomposition and Detection of Cocaïne in the Body in Cases of Poisoning . . . . ii, 336
Jolles (Adolf). Detection of Bile Pigment in Urine . . . . ii, 336
Boot (J. C.). Apparatus for the Rapid Calibration of Measuring Vessels ii, 368
Perman (Edgar P.) and W. John. Standardising Acid Solutions . . ii, 368
Walker (James) and James Henderson. Carius-Volhard Estimation of Halogens . . . . ii, 368
Collan (Uno). Estimation of Sulphurous and Sulphuric acids in the Products of the Combustion of Coal-gas . . . . ii, 368
Warren (Henry N.). Detection and Estimation of Selenium in Meteoric Iron . . . . ii, 369
Liechti (Paul). Apparatus for Measuring out small drops of Mercury for Kjeldahl's Process . . . . ii, 369
Pfeiffer (Theodor) and H. Thurmann. Estimation of Nitric Nitrogen in Presence of Organic Nitrogen . . . . ii, 369
Edwards (Vincent). Practical working of Pelouze's Process . . ii, 370
Schiff (Robert). Preparation of Thioacetic acid and its Application in Chemico-legal Investigations . . . . ii, 370
Gasselin (V.). Analysis of Organic Compounds containing Boron and Fluorine . . . . ii, 370
Richards (Theodore W.) and Harry G. Parker. The Inclusion of Barium Chloride by Barium Sulphate . . . . ii, 370

PAGE
Barthe (Léonce). Volumetric Estimation of Zinc . . . ii, 371
Cushman (Allerton S.). Separation of Copper from Cadmium . . . ii, 371
Brunck (Otto). Estimation of Antimony as Tetroxide . . . ii, 372
Denigés (Georges). Estimation of Thiophen in Benzene . . . ii, 372
Thomson (Robert T.). Preservative Value of Formaldehyde and its Detection in Milk . . . ii, 373
Krüger (Martin). Precipitation of Uric acid and Xanthine Derivatives ii, 373
Nahm (A. N.). New Method of Estimating Fat in Milk . . . ii, 373
Milone (Ugo). Modification of Tollens Fat Extraction Apparatus . ii, 374
Mörner (Carl T.). Butter . . . ii, 374
Bremer (Hermann). Iodine Absorption. . . . ii, 374
Schattenfroh (Arthur). Pumpkin Oil. . . . ii, 374
Lamal. New Test for Morphine . . . ii, 375
Davoll (David L., Jun.). Fallacies of *Post Mortem* Tests for Morphine . . . ii, 375
Beckmann (Ernst O.). Estimation of Gelatin and Albumin in the Presence of Peptone . . . ii, 375
Bogmolow. Application of Dyes to the Recognition and Distinction of Diverse Proteïds . . . ii, 376
Gantter (Friedrich). Medico-legal Detection of Blood Stains . . . ii, 376
Dobriner (P.). Source of Error in Alkalimetry . . . ii, 410
Autenrieth (Wilhelm). Luteol: A New Indicator . . . ii, 411
Philips (A.). Modification of Soxhlet's Extraction Apparatus . . ii, 411
Küster (Fritz W.). Estimation of Halogens by Carius' Method: Application of Volhard's Modification . . . ii, 411
Gladding (Thomas S.). Estimation of Sulphur in Pyrites . . . ii, 411
Campredon (Louis). Estimation of Sulphur in Iron and Steel . . ii, 411
Heusler (Friedrich). Estimation of Sulphur in Petroleum . . . ii, 412
Shiver (F. S.). Standardising Sulphuric Acid. . . . ii, 413
Lunge (Georg). Assay of Fuming Sulphuric Acid. . . . ii, 413
Pasquali (Adalberto). Chemical and Toxicological Properties of Hydroxylamine . . . ii, 413
Noyse (William A.) and J. S. Royse. Volumetric Estimation of Phosphorus in Steel and Cast Iron . . . ii, 414
Jüptner (Hans v.). Estimation of Phosphoric Acid by means of Ammonium Molybdate . . . ii, 414
Roode (Rudolf de). Estimation of Phosphoric acid by the Molybdic acid-magnesia Process . . . ii, 414
Pemberton (H.). Estimation of Phosphoric acid . . . ii, 415
Tarugi (N.). Preparation of Thioacetic acid and its Use in Toxicology . ii, 415
Friedheim (Carl) and Paul Michaelis. Separation of Arsenic from other Elements by means of Methylic Alcohol and Hydrogen Chloride . . . ii, 415
McMillan (Walter G.). Two new Colorimeters for Carbon Estimations . . . ii, 416
Horne (W. D.). Analysis of Bone-black. . . . ii, 416
Bredt (Julius) and Wilhelm Posth. Absorption Apparatus for Elementary Analysis . . . ii, 417
Roode (Rudolf de). Estimation of Potash in Kainite . . . ii, 417
Carrigues (W. E.). Estimation of Potash in Manures . . . ii, 417
Hugounenq (L.). Estimation of Potassium Sulphate in Wine . . ii, 418
Linebarger (C. E.). Reaction between Zinc Sulphate and Potassium Hydroxide . . . ii, 418
Lescœur (Henri). Volumetric Estimation of Metals . . . ii, 418
Kreichgauer (Andreas). Estimation of Lead . . . ii, 418
Jannasch (Paul) and H. Kammerer. Quantitative Analysis of Galena . ii, 418
Dulin (R. S.). Wet Copper Assay . . . ii, 419
Engels (Carl). Quantitative Separation of Metals in Alkaline Solution by Hydrogen Peroxide . . . ii, 419
Gröger (Max). Electrolytic Estimation of Manganese . ii, 419

PAGE
THOMAS (W. S.). Estimation of Manganese . . . . ii, 420
JÜPTNER (HANS V.). Estimation of Iron in Ores, Slags, &c. . . . ii, 420
MIXER (C. T.) and H. W. DUBOIS. The Zimmermann-Reinhardt Method for Estimating Iron in Iron Ores . . . . ii, 420
BAMBER (H. K.). Analysis of Steel . . . . ii, 420
LAPICQUE (LOUIS). Estimation of Iron in Urine . . . . . ii, 421
CAMPBELL (EDWARD D.) and W. H. ANDREWS. Estimation of Nickel in Nickel-steel. . . . . ii, 421
JANNASCH (PAUL), ED. ROSE, and R. NIEDERHOFHEIM. Separation of Metals with a Current of Carbonic Anhydride containing Bromine . . . . ii, 422
JANNASCH (PAUL) and H. KAMMERER. Separation of Metals in Alkaline Solution by means of Hydrogen Peroxide . . . . ii, 423
HEUSLER (FRIEDRICH) and JOS. HERDE. Estimation of Paraffin in Crude Anthracene . . . . ii, 423
SCHNEIDER (EDWARD A.). Detection of Potassium Cyanate in Potassium Cyanide . . . . ii, 424
RUIZAND (L.). Discrimination between Lactose and Glucose in Adulterated Peptones . . . . ii, 424
BLYTH (ALEXANDER WYNTER). Identification and Estimation of Carbohydrates in Milk. . . . . ii, 425
BAU (A.). Melitriose (Raffinose) and its Estimation . . . . ii, 425
HIBBARD (P. L.). Estimation of Starch . . . . ii, 426
RICHMOND (H. DROOP) and L. KIDGELL BOSELEY. Detection of Formalin . . . . ii, 426
WELBEL (B.) and S. ZEISEL. Estimation of Furfuraldehyde in Pentoses and Pentosans . . . . ii, 426
SPICA (MATTEO). Detection of Salicylic Acid in Wines . . . . ii, 426
RICHMOND (H. DROOP). Maumené's Test for Oils . . . . . ii, 427
HEHNER (OTTO) and CHARLES A. MITCHELL. New Thermal Method for Examining Oils . . . . ii, 427
HEHNER (OTTO). Gravimetric Estimation of Bromine Absorption of Fats . . . . ii, 428
EPHRAIM (JULIUS). Hübl's Iodine Method . . . . ii, 428
SCHJERNING (N. C. HENRIK). The Amorphous Nitrogenous Organic Compounds in Beer Wort . . . . ii, 428
GOOCH (FRANK A.) and CHARLOTTE FAIRBANKS. Estimation of Halogens in Mixtures of their Silver Salts . . . . ii, 459
JANNASCH (PAUL) and A. RÖTTGEN. Estimation of Fluorine . . . ii, 460
GOOCH (FRANK A.) and I. K. PHELPS. Precipitation and Gravimetric Estimation of Carbonic Anhydride . . . . ii, 460
GOOCH (FRANK) and C. F. CLEMONS. Estimation of Selenious Acid by Means of Potassium Permanganate . . . . ii, 461
PATUREL (G.). Estimation of the Manurial Value of Phosphates . . ii, 461
KREIDER (D. ALBERT). Use of Potassium Perchlorate for the Estimation of Potassium . . . . ii, 461
BAUBIGNY (HENRI). Analytical Characters of a Mixture of Salts of Barium, Strontium, and Calcium . . . . ii, 461
JANNASCH (PAUL) and F. SCHMITT. Separation of Metals in a Current of Hydrogen Chloride . . . . ii, 462
FRESENIUS (HEINRICH) and A. SCHATTENFROH. Detection and Estimation of Metals in Fatty Oils . . . . ii, 463
JONES (HARRY C.). Estimation of Formic acid by Potassium Permanganate . . . . ii, 463
HALENKE (A.) and W. MÖSLINGER. Analysis of Must and Wine . . ii, 463
ROESLER (LEONHARD). Analyses of Austro-Hungarian Sweet Wines . ii, 465
KIPPENBERGER (CARL). Examination of Decomposed Human Remains for Alkaloïds and Glucosides . . . . ii, 465
TENNILLE (GEORGE F.). The Phosphomolybdic acid Test in Lard Analysis . . . . ii, 467

PAGE
Vitali (Dioscoride). Tests for Distinguishing Atropine from Strychnine . . . ii, 467
Schneider (Josef). Estimation of Indigotin . . . ii, 468
Dutto. Estimation of Peptones . . . ii, 468
Bock (Oscar). Valve Pipette . . . ii, 525
Meineke (C.). Potassium Hydrogen Iodate in Volumetric Analysis . . . ii, 525
Ilosvay de Nagy Ilosva (Ludwig). New reactions of Hydrogen Peroxide . . . ii, 526
Mierczynski (v.). Gas Volumetric Estimation of Hydrogen Chloride in the Contents of the Stomach . . . ii, 526
Fresenius (C. Remigius). Detection and Estimation of Chlorate in Bleaching Powder . . . ii, 527
Reis (Moritz A. v.). Estimation of Sulphur in Iron . . . ii, 527
Koninck (Lucien L. de). Estimation of Sulphur in Iron . . . ii, 528
Mohr (Paul). Estimation of total Sulphur in Urine . . . ii, 528
Bömer (A.). Kjeldahl's Method of Estimating Nitrogen in Foods . . . ii, 528
Berger (Richard). Estimation of Nitric Acid . . . ii, 528
Jüptner (Hans v.). Eggertz's Phosphorus Test . . . ii, 530
Liebrich. Correct Estimation of Phosphorus in Iron and Steel . . . ii, 530
Hanamann (Joseph). Estimation of Phosphoric Acid with Molybdate . . . ii, 530
Carnot (Adolphe). Estimation of small quantities of Arsenic . . . ii, 531
Vanino (Ludwig). Titration of Arsenious Acid with Permanganate . . . ii, 531
Schneider (Leopold). Estimation of Carbon in Iron . . . ii, 531
Grünhut (Leo). Analysis of Liquefied Carbonic Anhydride . . . ii, 532
Bornträger (Arthur). Potassium Tetroxalate for Titrating Alkalis . . . ii, 532
Nevole (M.). Estimation of Alkalinity in Raw Sugars . . . ii, 532
Thomson (Isaac W.). Detection and Estimation of Sodium in Lithium Salts . . . ii, 532
Uslar (Carl v.). Separation of Mercury from Metals of the Arsenic and Copper Groups . . . ii, 532
Lasne (Henri). Estimation of Aluminium in Phosphates . . . ii, 533
Griggi (Gioachino). Detection of Iron in commercial Copper Sulphate . . . ii, 534
Knieder. Colorimetric Assay of Cobalt Ores . . . ii, 534
Moore (Thomas). Volumetric Estimation of Nickel . . . ii, 534
Friedheim (Carl) and Hans Euler. Estimation of Molybdenum . . . ii, 535
Friedheim (Carl) and Hans Euler. Volumetric Estimation of Molybdic and Vanadic Anhydrides in the same solution . . . ii, 535
Fresenius (C. Remigius) and E. Hintz. Estimation of Uranium in Earths containing Phosphoric and Vanadic Acids . . . ii, 536
Steen (Olav). Separation of Bismuth from Lead . . . ii, 536
Warren (Henry N.). Separation of Gold and Silver from Iron and Steel . . . ii, 536
Gantter (Friedrich). Gasometric Estimation of Glycerol . . . ii, 537
Focke (Hermann). Detection of small quantities of Sugar in Urine . . . ii, 537
Egeling (C. Guldensteeden). Testing Urine for Acetone . . . ii, 537
Glücksmann (Carl). Estimation of Hydrogen Cyanide . . . ii, 538
Burcker (E.). Estimation of the Volatile Acids in Wine . . . ii, 538
Salkowski (Ernst). Estimation of Uric acid and Xanthine Compounds in Urine . . . ii, 538
Zega (Alexander). Estimation in Butter of Fatty Acids Soluble in Water containing Sulphuric acid . . . ii, 539
Zehenter (Josef). Centrifugal Estimation of Fat in Milk . . . ii, 539
Beckmann (Ernst). Milk Analysis . . . ii, 539
Kühn (M.). Analysis of Cheese . . . ii, 539
Dormeyer (C.). Estimation of Fat in Animal Organs . . . ii, 540
Kreis (Hans). Detection of Earth Nut Oil . . . ii, 540
Schimmel & Co. Essential Oils . . . ii, 540
Kossel (A.) and H. Schmied. Estimation of Urea in Urine . . . ii, 541
Vedrödi (Viktor). Estimation of Nicotine and Ammonia in Tobacco . . . ii, 541

PAGE
HILGER (ALBERT) and A. EMINGER. Estimation of Theobromine in Cocoa Nibs and Cocoa . . . . ii, 542
CUSHMAN (ALLERTON S.). Detection and Estimation of Strychnine in Corpses . . . . ii, 542
RIEGLER (E.). Detection and Estimation of Albumin in Urine . . . ii, 542
STUTZER (ALBERT). Estimation of the Nitrogenous Constituents of Meat Extract and Commercial Peptones . . . . ii, 543
STUTZER (ALBERT). Analysis of Meat Extracts and Peptones . . . ii, 543
WINTER (J.). Analysis of Gastric Juice . . . . ii, 543
PUCHNER (H.). Estimation of Dry Matter in Peat . . . . . ii, 544

JOURNAL

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ABSTRACTS OF CHEMICAL PAPERS PUBLISHED IN BRITISH AND FOREIGN JOURNALS.

PART II.

General and Physical Chemistry.

Molecular Asymmetry and Rotatory Power of Organic Substances. By A. PIUTTI (*Gazzetta*, 1894, **24**, ii, 85—97).—The author gives an account of Guye's theory respecting the molecular rotations of organic substances, and shows that the most complete disaccord exists between the experimental and calculated rotations of many derivatives of asparagine. W. J. P.

Method of Determining Rotatory Dispersion by the Aid of Ray Filters. By H. LANDOLT (*Ber.*, 1894, **27**, 2872—2887).—To measure the rotatory dispersion of those substances which rotate the plane of polarised light recourse has hitherto been had to the combination of a polarimeter and a spectrometer; this combination, however, besides being too complicated for the chemical laboratory, necessitates a very powerful light. Hence the rotatory dispersion of but few substances has been determined.

The employment of sodium light has numerous disadvantages. Lamps that are constructed to furnish flames of sufficient brilliancy need frequent renewal of the sodium chloride, thereby interrupting observations; if sodium bromide be used as recommended by Fleischl v. Marxow (Abstr., 1890, 549), a stronger light is obtained, but this salt volatilises even more quickly than the chloride, and bromine vapour separates from the flame. The sodium light is not strictly homogeneous, and must be freed from other rays; this is best done by Lippich's method (*Zeit. Instrument-Kunde*, 1892, 340), namely, by allowing the light to pass through two glass troughs containing solutions of potassium dichromate and uranic sulphate respectively.

The author finds that it is possible to obtain fairly homogeneous light by selective absorption of white light in the manner to be described. v. Seherr-Thoss employs for this purpose coloured plates, mostly cut from mineral crystals. The author uses Auer's incandescent lamp as the source of light; ordinary gas and petroleum lamps are unsuitable for the purpose, as the light they emit is too poor in blue rays. Coloured glass is not to be recommended as an absorbing agent, on account of the difficulty of obtaining samples of like quality, and he therefore makes use of standard solutions of pure chemicals, which are contained in cylindrical glass troughs of 4 cm. diameter, divided into two or three compartments at definite intervals according to requirement. Lippich's polarimeter was used; instruments of the Laurent type being unsuited for the purpose.

In the case of Lippich's polarimeter, when sodium light is used, the sensitiveness corresponds with the inclination of the principal planes of the two Glan's prisms at an angle of about 3°. This angle is denoted by the symbol ϕ. When, however, the light employed is not strictly monochromatic, as in the case of that obtained by the aid of ray filters, this angle is increased to about 5° for red, green, and bright blue light, and to about 10° for yellow and dark blue light.

Red Light.—This may be obtained by the combination of a trough (20 mm. in length), filled with a solution of 0·05 gram of hexamethylpararosaniline hydrochloride (crystal violet 5BC), dissolved in alcohol and diluted with water to 1 litre, with a second trough (of the same length) filled with a 10 per cent. solution of normal potassium chromate. The light thus obtained, when examined in a spectroscope in which the slit of the collimator tube has a width of 0·25 mm., gives a single red band between wave-lengths 718 $\mu\mu$ and 639 $\mu\mu$.

Yellow Light.—A 30 per cent. nickel sulphate solution of 20-mm. length absorbs only the red rays; if the light be now passed first through a 15-mm. length of a 10 per cent. solution of normal potassium chromate, and subsequently through a like thickness of a solution of potassium permanganate containing 0·025 gram of that salt in 100 c.c. of water, the spectrum of the issuing light consists of a narrow, orange-yellow band between 614 $\mu\mu$ and 574 $\mu\mu$. The light so obtained is much less brilliant than that from a strong sodium flame, and the removal of the remaining portion of the red rays from it by further absorption cannot be effected without rendering the light too faint for use. With an angle of rotation higher than 20°, the two halves of the field appear of different colours, that is, red and yellow respectively.

Green Light.—Obtained by means of a 20-mm. length of an aqueous solution of copper chloride ($CuCl_2 + 2H_2O$; 60 grams in 100 c.c.), and a similar length of 10 per cent. solution of normal potassium chromate. The broad green band of this light is between 540 $\mu\mu$ and 505 $\mu\mu$.

Bright Blue Light.—"Double green SF," which consists of a compound of chloromethylhexamethylpararosaniline hydrochloride (methyl-green) with zinc chloride, is dissolved in water so that a solution containing 0·02 gram of the colouring matter in 100 c.c. is obtained. A 20-mm. length of this solution in conjunction with a similar length of a 15 per cent. solution of copper sulphate gives light which still contains green rays of wave-lengths between 526 $\mu\mu$ and 494 $\mu\mu$, and bright blue rays between 494 $\mu\mu$ and 458 $\mu\mu$.

Dark Blue Light.—Obtained by means of 20-mm. lengths of solution of "crystal violet 5BO" (0·005 gram in 100 c.c. of water); and of 15 per cent. copper sulphate solution; the wave-length of this light is between 478 $\mu\mu$ and 410 $\mu\mu$.

The following table shows the ratio between the values obtained with quartz by the method just described, and those obtained by that of Broch, who used light corresponding with different Fraunhofer lines.

Ray Filter.	α.	Fraunhofer lines.	α'.	Ratio. α'/α.
Red (r)	16·78°	C	17·31°	1·0316 $\alpha_r = \alpha_C$
Yellow (y)	21·49	D	21·71	1·0102 $\alpha_y = \alpha_D$
Green (g)	26·85	E	27·54	1·0257 $\alpha_g = \alpha_E$
Bright blue (bb)	32·39	F	32·76	1·0114 $\alpha_{bb} = \alpha_F$
Dark blue (db)	39·05	G	42·59	1·0907 $\alpha_{db} = \alpha_G$

The ratios shown in the last column give therefore the factors by which the values obtained by the ray absorption method are to be multiplied in order to convert them into those corresponding with definite Fraunhofer lines. In the table which follows, the agreement is shown between the calculated and directly observed values for sodium light.

	Observed. α_y.	Calculated. α_D.	Observed. α (sodium).
Quartz plate (2·547 mm.)	54·74°	55·29°	55·295°
,, (1·575 mm.)	33·85	34·19	34·19
,, (0·519 mm.)	11·15	11·26	11·27
Tartaric acid (aqueous solution)	7·92	8·00	8·02
Turpentine oil	15·77	15·93	15·94
Camphor (alcoholic solution)	26·26	26·52	26·70

From the observed rotatory powers calculated for 1 mm. of quartz, the wave-lengths corresponding with the light of the five different colours may be ascertained. From these, the rotatory dispersion of quartz may be calculated by Boltzmann's formula

$\alpha = \frac{A}{\lambda^2} + \frac{B}{\lambda^4}$, which, with the constants

$$\alpha = \frac{7·108293}{10^6 . \lambda^2} + \frac{0·1477086}{10^{12} . \lambda^4},$$

gives values agreeing closely with those of Soret and Sarasin (*Compt. rend.*, 1882, **95**, 637). The wave-lengths corresponding with the rotatory powers are as follows.

	Red.	Yellow.	Green.	Bright blue.	Dark blue.
α	16·78°	21·49°	26·85°	32·39°	39·05°
λ	665·9	591·9	553·0	488·5	448·2 $\mu\mu$.

The rotatory dispersion of saccharose, in aqueous solution, was determined by the new method, the results being in close agreement with those of Seyffart, Stefan, and Arndtsen. In the case of santonin, however, which was examined in chloroform solution, the values obtained for the rotatory dispersion by the new method differ considerably from those of Nasini; this is, however, accounted for by the magnitude of the angle of rotation of santonin solution.

In an appendix to this paper, the author shows that, by making use of a Linneman's oxy-coal gas-burner and a zirconia cylinder, a sufficiently strong light may be obtained to render possible the employment of the following combination. 40 mm. of nickel sulphate solution (22 grams in 100 c.c.), 15 mm. of normal potassium chromate solution (10 grams in 100 c.c.), and 15 mm. of potassium permanganate solution (0·025 gram in 100 c.c.). The light thus obtained gives a narrow, yellow band between 614 $\mu\mu$ and 578 $\mu\mu$, containing a very small residue of red rays. The rotatory powers (when not too high or when the dispersion is not too great) observed with the aid of this light agree closely with those in which sodium light is employed. A. R. L.

Dependency of the Electrical Conductivity of Organic Salts on the Temperature. By A. Bartoli (*Gazzetta*, 1894, **24**, ii, 156—172).—This paper describes the results of a continuation of the author's investigations of the electrical conductivity of organic substances (Abstr., 1886, 191); he draws the following conclusions from a study of about 60 aliphatic salts. At ordinary temperatures, or at the boiling points, the electrical conductivities of aliphatic alkylic salts of small molecular weight is greater than those of their higher homologues. The electrical conductivity of such salts increases with the temperature, the coefficient of increase of conductivity being greater for salts of high molecular weight than for their lower homologues; the temperature coefficient of the conductivity therefore increases as the viscosity of the salt increases. In the one or two cases in which the conductivity decreases with rise of temperature, the anomalous behaviour can be explained by assuming the presence of a trace of an aliphatic alcohol. The conductivity of a salt may be caused to decrease with rise of temperature by adding from 1 to 20 per cent. of any aliphatic alcohol; the electrical conductivity of a salt still increases as the temperature is raised on adding to it aniline, paraldehyde, a phenol, a ketone, or an acid. W. J. P.

Electrolysis of Copper Sulphate. By A. Chassy (*Compt. rend.*, 1894, **119**, 271—272).—When a hot solution of copper sulphate is electrolysed, a remarkable violet-red deposit is usually obtained. With platinum electrodes and a current of 0·01 ampère per sq. cm., an almost neutral saturated solution of pure copper sulphate at 100° yields a bright-red deposit of microscopic crystals derived from the cube and octahedron. These crystals consist of cuprous oxide. Below 100°, the cuprous oxide becomes mixed with crystals of copper, the proportion of which is higher the lower the temperature. A similar effect is produced by increasing the strength of the current or diluting the solution.

If the positive electrode consists of copper, its loss of weight is always distinctly lower than the gain in weight of the negative electrode. Moreover, if the voltameter containing the hot solution is connected in the same series with a voltameter containing a cold solution, the weight of the deposit in the former is always much greater than would correspond with the oxidation of the copper deposited in the latter. C. H. B.

Volume Changes in Elements during Melting. By M. Toepler (*Ann. Phys. Chem.*, 1894, [2], **53**, 343—378).—The volume change during melting was determined for a number of elements, and the constant (K_e) expressed in c.c. per gram of the element. In the case of elements whose melting points were sufficiently low, glass dilatometers were employed, a column of paraffin or oil protecting the molten element if necessary. The reading was taken at a number of temperatures in the neighbourhood of the melting point for both liquid and solid states, and the difference of the ordinates of the two curves at this temperature gave the required data. In the case of elements with high melting points, an iron vessel was employed, which was filled with the molten element; this was allowed to solidify, and the volume of the cup-shaped depression formed during solidification was determined by the weight of water required to fill it. In the case of sulphur, which can be easily supercooled, the volume-change is given for a number of temperatures, and the volume changes during the transformation of the different modifications of selenium are recorded and depicted graphically. Numerous curves are given, that of sulphur showing a well-marked maximum value at about 180°. The results obtained are given in the accompanying table.

Element.	k_e.	Per cent.	Element.	k_e.	Per cent.
Sodium	0·0264	2·5	Cadmium	0·0064	5·2
Aluminium	0·019	4·8	Tin	0·0039	2·8
Sulphur	0·0287	5·5	Antimony	0·0022	1·4
Potassium	0·030	2·5	Tellurium	0·0123	—
Zinc	0·010	—	Iodine	0·0434	21·1
Selenium	0·018	—	Thallium	0·0027	3·1
Bromine	0·0511	—	Lead	0·0034	3·7
Rubidium	0·014	—	Bismuth	−0·0034	−3·27

The author points out that if the constants are taken as ordinates, and the atomic weights as abscissæ, a curve is obtained closely resembling that of the atomic values, so that k_e is a periodic function of the atomic weight. It is also closely connected with the coefficient of expansion, but the formula expressing the relationship is left undetermined. L. M. J.

The Change in the Specific Heat of Water between 0° and + 32°. By A. Bartoli and E. Stracciati (*Gazzetta*, 1894, **24**, ii, 145—

152; compare Abstr., 1893, ii, 443).—The authors have determined the specific heat of water at temperatures between 0° and 35°, by three different methods; the results obtained by the three methods usually agree to one part in 10,000. The specific heat of water C, referred to the specific heat at 15° as unity, is represented between 0° and 35° by the following equation, temperatures being measured on the hydrogen thermometer.

$$C = 1{\cdot}00688 - 0{\cdot}000{,}556t - 0{\cdot}000{,}006{,}15t^2 + 0{\cdot}000{,}001{,}015t^3 - 0{\cdot}000{,}000{,}013t^4.$$

W. J. P.

Specific Heat of Water at Constant Volume. By A. Bartoli and E. Stracciati (*Gazzetta*, 1894, **24**, ii, 152—155; compare preceding abstract).—The specific heat of water at constant volume calculated from Thomson's formula, using the author's experimental results, decreases continuously as the temperature rises; the ratio of the specific heat at constant pressure to that at constant volume decreases from 0° to + 4°, and then increases continuously up to 35°, the highest temperature at which determinations were made.

W. J. P.

The Critical State. By W. Ramsay (*Zeit. physikal. Chem.*, 1894, **14**, 486—490).—The author contends against the supposition that at the critical temperature the liquid and gas possess distinct individuality, and describes the method he adopts for obtaining pure ether at its critical temperature, complete details being given, as absolute purity is a matter of vital importance. The ether, contained in a ring-shaped tube, is heated by the vapour of pure quinoline in a jacket connected with a reservoir and pump so that the temperature can be accurately altered to a small fraction of a degree. At about 193·5° the surface of the ether becomes nebulous, and at this point a slight cooling of the one side of the jacket causes a sinking of the substance at that side, and a corresponding rise on the other, owing to the great expansibility in the neighbourhood of the critical temperature; by further cooling a complete circulation of the ether may be effected. The appearance of streaks, usually taken as a sign of the critical state, is no indication, as the nebulosity, when examined by a polariscope, shows the presence of liquid particles suspended in the gas like a cloud. The critical point can, however, be found from two density observations taken at two neighbouring points, the curve being considered a parabola. The critical point of ether, he hence concludes, is 194·7° or 194·8°, and he emphasises his opinion that at this temperature the substance is completely homogeneous.

L. M. J.

Critical Density. By P. A. Guye (*Chem. Centr.*, 1894, i, 712—713).—The critical density is, according to van der Waals, equal to 2·667 times the theoretical, but the experiments of Young lead to the value 3·85 for the factor. The author points out that, according to a correction of O. Meyers, the ratio should be 3·77. L. M. J.

The Volume Changes attending the Mixture of Liquids, in Relation to Cryoscopic Behaviour. By E. Paternò and C.

MONTEMARTINI (*Gazzetta*, 1894, **24**, ii, 179--190).—The authors have commenced an investigation of the molecular complexity of liquids, and give the results of some preliminary experiments on the densities of mixtures of benzene with methylic, ethylic, isopropylic, isobutylic, caproic and benzylic alcohols, acetic and isobutyric acids and anethoïl.

W. J. P.

Determination of the Osmotic Pressure of Albuminous Liquids by the Cryoscopic Method. By H. J. HAMBURGER (*Rec. Trav. Chim.*, 1894, **13**, 67—79).—The author has determined, by the cryoscopic method, the osmotic pressure of several albuminous liquids, such as the blood-serum of the horse and of the ox. The results obtained agree with those arrived at by the plasmolytic method, so that it is possible to substitute for this method that of the reduction of the freezing point when difficulty might be experienced in applying the former.

H. C.

Lowering of the Freezing Point. By H. C. JONES (*Ann. Phys. Chem.*, 1894, [2], **53**, 392—395).—The results of the author's determinations of the reduction of the freezing point are not concordant with those of Loomis, and suggestions of possible errors in the author's results were made by Kohlrausch (Abstr., 1894, ii, 228). These, however, do not appear to be the true cause of the differences, and suggestion is made of possible impurity in some of Loomis' compounds. The author's results in the case of phosphoric acid are shown to agree well with those of Arrhenius, whilst the results of Loomis differ by as much as 25 per cent.; the "dissociation," as calculated from the author's numbers, also agrees in most cases with that obtained by Kohlrausch by the conductivity method.

L. M. J.

Solubility of Mixed Crystals of Pairs of Isomorphous Salts. By W. MUTHMANN and O. KUNTZE (*Zeit. Kryst. Min.*, 1894, **23**, 368—378).—The authors have examined the equilibrium between solid solutions of several pairs of isomorphous salts and their aqueous solutions. The equilibrium between potassium dihydrogen arsenate, and phosphate at 7° is typical of case 1 of Roozeboom's classification (Abstr., 1892, 265), a case not hitherto met with in practice. The curve connecting the composition of the mixed crystals with that of their solution is only slightly above the straight line making 45° with each co-ordinate, that is to say, the composition of the solution differs but slightly from that of the deposited crystals.

The equilibrium between potassium perchlorate and permanganate and their mixed solutions at 7° is of the same kind as that between the potassium and thallium chlorates and their solution (Abstr., 1892, 266); the same is true of potassium and rubidium permanganates.

W. J. P.

Relation between the Constitution of Fatty Acids and the Solubility of their Salts. By A. LIEBEN (*Monatsh.*, 1894, **15**, 404—414).—On comparing the solubilities of the calcium, barium, and silver salts of fatty acids, the author finds there are fixed relations, according to definite laws, between the constitution of the acids and the solubility of their salts. In the case of the normal acids, the relation is exceedingly simple, each substitution of a methyl group for hydrogen producing a regular change in the solubility of the salts; but in the case of acids other than normal, the connection, although it undoubtedly exists, is not nearly so simple. G. T. M.

Polymerisation of Liquid Molecules. By P. A. GUYE (*Chem. Centr.*, 1894, i, 712).—The researches of Ramsay and Shields indicate polymerisation in liquids in which it had previously appeared probable owing to the deviations from van der Waals' law. Polymerisation is also probably indicated in the following case:—(1) If the curve which expresses the mean between the densities in the liquid and gaseous states is not a straight line; (2) if the heat of vaporisation does not decrease continuously with the temperature, but exhibits a maximum value; (3) if the vapour pressure curve cuts those of other liquids; (4) if, in the expression $\log \pi - \log p = k \frac{\theta - T}{T}$ (where π and θ are the critical pressure and temperature), the constant k does not possess the normal value 3·06; it should be noticed, however, that a normal value does not necessarily indicate absence of polymerisation. For the determination of physicochemical laws, liquids should be chosen in which the molecular state remains unchanged, as otherwise it is probable that the laws are masked, and appear too complicated. L. M. J.

Velocity of Reaction between Alkylic Sulphides and Alkylic Iodides. By G. CARRARA (*Gazzetta*, 1894, **24**, ii, 68—75; compare Abstr., 1893, i, 633).—The author has previously shown that it is not improbable that, in the thetines, the four valencies of the sulphur atom are of different values. If this is really so, then the velocity of action between ethylic iodide and methylic sulphide should be different from the velocity of reaction of methylic iodide and methylic ethylic sulphide, although the product is, in both cases, dimethylethylthetine. As has been previously shown (Abstr., 1894, ii, 309, 310), these reactions are of the second order, and the expression $\frac{x}{t(A-x)}$ is constant and equal to AC.

The value AC in the two cases is fairly constant; in the action between methylic sulphide and ethylic iodide, it is 0·00027 at 0°, and in the action of methylic ethylic sulphide on methylic iodide it has the value 0·01223 at 0°. Similarly, the action between ethylic iodide and methylic ethylic sulphide has the velocity constant 0·00014 at 0° and 0·0562 at 36°; the action between methylic iodide and ethylic sulphide proceeds with the velocity 0·00697 at 0°.

As the author remarks, however, these figures do not afford a decisive proof of the different values of the valencies of sulphur, since it has been repeatedly shown (Menschutkin, Abstr., 1890, 1366) that the velocity of reaction of methylic iodide is greater than that of ethylic iodide, the product of the action being the same in the two cases. W. J. P.

An Aluminium Air Bath. By L. MEYER (*Ber.*, 1894, **27**, 2769—2770).—Aluminium may be used with advantage for the construction of the air baths devised by the author, on account of its high conductivity for heat and its permanence in the air. The layer of oxide formed does not scale off. The apparatus has now been constructed with side doors, which are more convenient for many purposes than those opening from the top. A. H.

Inorganic Chemistry.

Ratio of the Atomic Weights of Hydrogen and Oxygen. By L. MEYER and K. SEUBERT (*Ber.*, 1894, **27**, 2770—2773).—Thomsen has recently (Abstr., 1894, ii, 277) calculated the ratio of the atomic weights of hydrogen and oxygen from the experimental equivalent-ratio of ammonia and hydrogen chloride. The authors point out that in the equation employed by Thomsen, $H = \frac{r\mathrm{Cl} - \mathrm{N}}{3 - r}$, in which r is the experimentally determined ratio of ammonia to hydrogen chloride, there is an uncertainty of 0·01 in the atomic weights of chlorine and nitrogen, which may produce an error of no less than 0·5 per cent. in the ratio of hydrogen to oxygen, whereas, to be of value in deciding the question as to the true atomic ratio of these two elements, the possible error should not exceed 0·06. A. H.

A New Explosive Mixture. By A. ANGELI (*Gazzetta*, 1894, **24**, ii, 52—58).—The action which occurs when a mixture of potassium nitrate, potassium carbonate and sulphur explodes is usually represented by the equation

$$6KNO_3 + 2K_2CO_3 + 5S = 6N + 2CO_2 + 5K_2SO_4.$$

On substituting potassium nitrite for the nitrate, a mixture is obtained which explodes in much the same way as the above. It is therefore probable that, during the fusion preceding the explosion, potassium nitrite is formed by the reducing action of potassium sulphide, which, in turn, owes its formation to the interaction of the potassium carbonate and sulphur.

A mixture of potassium nitrate with hypophosphite detonates in a similar manner, and potassium nitrite is found in the product obtained on cautiously melting potassium nitrate and hypophosphite together; the same is true of mixtures of nitrates and thiocyanates. On heating a mixture of sodium thiocyanate with potassium nitrate, it first melts and then deflagrates slightly, whilst a mixture of the thiocyanate with potassium nitrite detonates violently. W. J. P.

Hyposulphurous acid. By E. SCHÄR (*Ber.*, 1894, **27**, 2714—2722).—Attention is drawn to the fact, hitherto overlooked, that Schönbein had prepared hyposulphurous (hydrosulphurous) acid and investigated many of its properties, several years before Schützenberger occupied himself with the subject. Schönbein found that when an indigo solution has been bleached with hyposulphurous acid, the colour can be restored, not only by oxidising, but also by reducing, agents, and even by heating in the absence of air. He thought, in consequence, that the original loss of colour must be due to the formation of an unstable compound of the colouring matter with the hyposulphurous acid. The author has repeated and extended Schönbein's experiments, and confirmed his results; he also is of opinion that the decolorisation of indigo by hyposulphurous acid cannot be explained satisfactorily as a reduction of the colouring matter. C. F. B.

Electrolysis of Nitrosylsulphuric acid in Sulphuric acid Solution. By A. GURCMAN (*Zeit. anorg. Chem.*, 1894, **7**, 161—166).—The apparatus employed for the electrolysis is so arranged that the electrodes are separated by a narrow tube in order that diffusion may be prevented as much as possible. A current of 4 volts, and not more than 0·1 ampère, is used. In the case of a solution containing 0·00316 gram of nitrous anhydride per 1 c.c., and using sulphuric acid of sp. gr. = 1·837, gas is evolved more quickly at the positive than at the negative pole, but the amount of gas evolved at the negative pole soon becomes greater than that at the positive pole. The liquid then becomes violet, and, after 40 hours' action, the evolution of gas at the negative pole ceases. As the electrolysis proceeds, the amount of nitric oxide evolved at the negative pole gradually diminishes; even when the amount has become very small, the solution still contains nitrosylsulphuric acid. The positive ions of the nitrosylsulphuric acid, NO and H, are liberated at the negative pole, the negative ion, SO_4, wanders to the positive pole and is split up into O and SO_3; the latter then re-forms sulphuric acid. The oxygen oxidises a portion of the nitrosylsulphuric acid to nitric acid, the latter being reduced by the nitric oxide to nitrous acid, which then regenerates nitrosylsulphuric acid. Neither ammonia nor hydroxylamine are formed during the electrolysis.

With a solution containing 0·00326 gram of nitrous anhydride per 1 c.c., and using sulphuric acid of sp. gr. = 1·65, the electrolysis proceeds in a similar manner, but, after electrolysis, the residual acid contains no nitrous acid. E. C. R.

Metallic Double Salts of Diammonium and Diamide. By T. CURTIUS and F. SCHRADER (*J. pr. Chem.*, 1894, [2], **50**, 311—346).—Hydrazine unites with either one or two equivalents of an acid to form salts. The compounds with two equivalents may be looked on as containing a bivalent radicle, diammonium, $(N_2H_6)''$, related to the metals of the alkaline earths in the same way as the ammonium radicle is related to the alkali metals.

The salts containing one equivalent of acid are more stable than the others, and correspond with the very stable hydrate, N_2H_4,H_2O. These salts form a number of crystalline double salts with the sulphates and chlorides of many of the metals, but do not appear to be capable of forming alums. The following salts have been prepared.

1. Double sulphates. These are of the general formula

$$(N_2H_5)_2SO_4,RSO_4,$$

in which R may be Cu, Co, Ni, Fe (ous), Mn, Zn, or Cd.

These salts are all sparingly soluble in water, and differ from the corresponding ammonium salts [such as $(NH_4)_2SO_4NiSO_4 + 6H_2O$] by containing no water of crystallisation. They are all obtained in the form of crystalline precipitates by mixing solutions of the two component salts.

2. Double chlorides. These are of the types N_2H_5Cl,RCl_2 and $2N_2H_5Cl,RCl_2$.

Diammonium mercuric chloride, $2N_2H_5Cl,HgCl_2$, is readily soluble, and may be recrystallised from water or alcohol. It forms well-developed, six-sided prisms, which become opaque in the air, and melt at 178° without decomposing. *Diammonium cadmium chloride*, $N_2H_5Cl,CdCl_2$, forms delicate needles, whilst the *bi-salt*, containing two molecules of hydrazine hydrochloride, $2N_2H_5Cl,CdCl_2 + 4H_2O$, separates in coarse prisms. *Diammonium zinc chloride*, $N_2H_5Cl,ZnCl_2$, forms hygroscopic, six-sided prisms, melting between 180° and 185°. The *bi-salt*, $2N_2H_5Cl,ZnCl_2$, crystallises in brittle, white, deliquescent needles, melting at 135°, and is difficult to prepare pure. The two double salts with stannous chloride are difficult to separate. The salt, $N_2H_5Cl,SnCl_2$. crystallises in large, nacreous plates, melting at 105°; the salt, $2N_2H_5Cl,SnCl_2$, is very hygroscopic, and melts at 55—60°.

Hydrazine also forms a series of salts analogous to the ammonia compounds, as ammonionickel sulphate, $NiSO_4,6NH_3$, and ammoniozinc chloride, $ZnCl_2,4NH_3$.

When diammonium copper sulphate is dissolved in ammonia, the cupric salt is reduced to a cuprous salt, and nitrogen is rapidly evolved. The double salts of iron, manganese, mercury, and tin behave in a similar or analogous manner, whilst those of nickel, zinc, and cadmium form double salts, $NiSO_4,3N_2H_4$, $ZnSO_4,2N_2H_4$, $ZnCl_2,2N_2H_4$, and $CdCl_2,2N_2H_4 + H_2O$, which may also be prepared by adding hydrazine hydrate to a solution of the metallic salt.

It has hitherto been found impossible to prepare free hydrazine from any of these salts; the double zinc chloride, for example, does not yield any reducing substance when heated, but evolves ammonia. Researches in this direction are being continued. Hydrazine hydrate reduces molybdenum trioxide to the dioxide, does not affect tungstic acid, and reduces chromates and ferric salts to the corresponding lower oxides.

Hydrazine hydrate in the pure state can be preserved without undergoing any alteration, whereas its dilute solution rapidly loses its characteristic properties, even when kept in a sealed tube. The exact nature of the decomposition has not yet been made out.

A. H.

Action of Nitric Oxide on Metals at High Temperatures. By F. Emich (*Monatsh.*, 1894, **15**, 375—390; compare Abstr., 1892, 940; 1893, ii, 66).—The author generally confirms the results obtained by Sabatier and Senderens (Abstr., 1892, 1151 and 1271), and concludes that the action of nitric oxide on the metals closely resembles, but is much slower than, that of oxygen, provided the temperature of the former gas is kept below the point at which its decomposition commences. Experiments with copper, zinc, cadmium, mercury, tin, lead, chromium, molybdenum, tungsten, uranium, manganese, iron, nickel, cobalt, titanium, and vanadium show that only three of these metals, namely, copper, lead, and vanadium, give products (Cu_2O, PbO, and Vd_2O_3 respectively) different from those obtained on heating them in a current of oxygen. In the case of mercury, the metal is not affected by nitric oxide at or below the temperature at which it boils.

G. T. M.

Nitrous Anhydride. By G. Lunge and G. Porschnew (*Zeit. anorg. Chem.*, 1894, **7**, 209—250).—These investigations were carried out in order to settle the question of the existence or non-existence of nitrous anhydride in the gaseous state. All conceivable precautions were taken to obtain pure materials for the investigation and to avoid sources of error, and many of the experiments made by previous investigators were repeated with additional precautions. The composition of the nitrogen oxides was determined by absorbing them by sulphuric acid, and either, *a*, estimating the total weight and total nitrogen, or, *b*, estimating the total nitrogen, and the amount of oxygen (in the form of permanganate) needed for complete oxidation.

1. *Action of Oxygen on excess of Nitric Oxide.*—Special precautions were taken to ensure thorough mixing of the gases. In no case did any oxygen remain uncombined, the whole quantity employed being found in the absorbed nitrogen oxides.

2. *Behaviour of a Mixture of Nitric Oxide and Peroxide towards Sulphuric acid.*—Nitric peroxide is well known to be readily absorbed by strong sulphuric acid, whilst nitric oxide is scarcely absorbed at all by that acid. In mixtures, nitric oxide was found to be readily absorbed when not present in excess of the proportion $NO : NO_2 : : 1 : 1$. The absorption by sulphuric acid gives, therefore, no indication whether a gas is nitrous anhydride or a mixture of nitric oxide and peroxide in molecular proportion.

Action of excess of Oxygen on Volatilising Nitrous Anhydride.—The results showed that when excess of oxygen was present the whole of the nitrogen oxides (nitrous anhydride ?) was converted into peroxide. The results obtained by Lunge, which seemed to show a resistant power of the N_2O_3 molecule to further addition of free oxygen, were probably due to incomplete mixing of the reacting gases.

Action of Nitric Oxide on Nitric Peroxide.—Above 28°, no contraction, and consequently no combination, of the two gases could be observed when they were mixed. At −21° and below, nitric oxide is freely absorbed by liquid nitric peroxide with formation of a blue liquid having the composition N_2O_3; mixtures of the two oxides, when cooled to −21°, yield the same blue liquid. These results are in contradiction to those of Hasenbach (*J. pr. Chem.*, 1871, [2], **4**, 1) and of Ramsay (Trans., 1890, 590). Ramsay states that by passing nitric oxide through liquid nitric peroxide only about 3·5 per cent. of the latter is absorbed. He estimated this absorption, however, by the gain in weight of the peroxide, and did not allow for the loss of weight due to nitric peroxide carried away by the escaping nitric oxide. The blue liquid has the exact composition N_2O_3, and when exposed in sealed tubes to the ordinary temperature the colour changes to green —the colour of liquid nitric peroxide. From this, the authors conclude that nitrous anhydride exists as a well-characterised chemical compound at $-21°$, but that at ordinary temperatures (that is, above its boiling point) partial decomposition sets in, even under pressure, and whilst it is still in the liquid state.

Vapour Density Determinations of Volatilised Nitrous Anhydride.— Very careful determinations at ordinary temperatures and in vacuous vessels failed to show any excess in density over that of a mixture of nitric oxide and peroxide. The density was determined by the weight and pressure as registered by a manometer formed of a Hempel burette partly filled with carbonic anhydride. L. T. T.

Formation of Hydrogen Phosphide. By J. W. Retgers (*Zeit. anorg. Chem.*, 1894, **7**, 265—266).—Based on some very old experiments of Fourcroy and Vauquelin, the text-books state that free hydrogen cannot be made to combine directly with phosphorus. The author finds that if a stream of hydrogen is passed over heated amorphous phosphorus, gaseous hydrogen phosphide is formed. The liquid and solid compounds are, at the same time, produced in small quantities. L. T. T.

Thiohypophosphates. By C. Friedel (*Compt. rend.*, 1894, **119**, 260—264).—When various metals are heated with the calculated proportion of phosphorus pentasulphide, or, better, amorphous phosphorus and sulphur, thiohypophosphates are obtained pure and in crystals. In some cases any excess of phosphorus sulphide can be removed by boiling with sodium hydroxide solution, or by heating out of contact with air, when the sulphide sublimes; but purification is always difficult, and the best results are only obtained by using the calculated quantities of materials.

Iron thiohypophosphate, $Fe_2P_2S_6$, forms brilliant, greyish-black, hexagonal lamellæ resembling those of graphite or specular hematite. The lamellæ, when very thin, are brown by transmitted light, and have no action on parallel polarised light. The compound is attacked by nitric acid, but more easily by a mixture of the acid with potassium chlorate.

The *aluminium* compound forms elongated, white lamellæ, which act on polarised light; it alters rapidly when exposed to air, and is decomposed by water with evolution of hydrogen sulphide. The *zinc* salt is pale yellow, and is difficult to obtain in a state of purity. The *copper* salt, $Cu_2P_2S_6$, forms small, acicular crystals, which act strongly on polarised light. The *lead* salt is purified by boiling for some time with water, and then forms an orange-yellow, crystalline powder, which acts strongly on polarised light, and is not decomposed by water. The *silver* salt is sulphur-yellow; at a dull red heat, it burns with a flame like that of phosphorus, and leaves a brown, brittle residue. The *mercury* salt, $Hg_2P_2S_6$, forms sulphur-yellow lamellæ, which act strongly on polarised light, and with a convergent beam shows rings. This compound is slowly decomposed by boiling water, and more rapidly by potassium hydroxide solution, a residue of mercuric sulphide being left. In presence of an excess of phosphorus sulphide, the compound can be sublimed, but it decomposes if strongly heated. When exposed to light, it gradually blackens.

Tin yields two compounds, $Sn_2P_2S_6$ and SnP_2S_6, according to the proportion of tin employed; the first is orange-yellow, is decomposed by boiling water with evolution of hydrogen sulphide, and dissolves completely in concentrated potassium hydroxide solution. The second compound forms yellowish-brown radiating crystals, which alter when exposed to air, becoming yellow and opaque, and giving off hydrogen sulphide. C. H. B.

Sodium Pyrophosphates. By T. SALZER (*Arch. Pharm.*, 1894, **232**, 365—375).—*Trisodium hydrogen pyrophosphate*, $Na_3HP_2O_7 + H_2O$, is prepared by evaporating a solution of the tetrasodium salt (13·5 grams) and the disodium salt (10 grams) in water (50 grams); it forms small crystals, is soluble in three parts of water at the ordinary temperature, is neutral to litmus, and with silver nitrate gives silver pyrophosphate, $Ag_4P_2O_7$. A salt of similar composition, but containing $7H_2O$, and crystallising in prisms, is formed when the disodium salt is employed in slight excess, and the solution gently warmed. It was only obtained in small quantity. *Sodium trihydrogen pyrophosphate*, $NaH_3P_2O_7$, mixed with metaphosphoric acid, was obtained from soda and pyrophosphoric acid. Attempts to prepare sodium tetraphosphate, $Na_6P_4O_{13}$, by heating trisodium hydrogen pyrophosphate were unsuccessful. A comparison of Fleitmann and Henneberg's and Uelsmann's sodium tetraphosphates shows that they are different; the former is probably a mixture, it crystallises in thin plates, and decomposes into disodium hydrogen phosphate and sodium dihydrogen phosphate in presence of water; the latter can be readily recrystallised, is deposited in small needles, and is not decomposed by the prolonged action of water. J. B. T.

Orthoplumbates of the Alkaline Earths. By G. KASSNER (*Arch. Pharm.*, 1894, **232**, 375—387).—Calcium plumbate, Ca_2PbO_4, combines with water at the ordinary temperature; the mixture solidifies, the colour changes from yellowish-red to pale yellow, and almost colourless, microscopic, transparent crystals of a *hydrate* containing $4H_2O$ are formed. With dilute nitric acid, the crystals turn brown, and finally become pulverulent.

By the action of water at 150°, a yellowish-green, voluminous powder is formed; with acids at the ordinary temperature, it darkens, becoming finally black; boiling dilute acetic acid rapidly produces the same change. Its composition agrees with that of a hydrate with $2H_2O$, but it appears to be a mixture of calcium hydroxide (3 mols.) and a hydrogen calcium diplumbate, $H_2CaPb_2O_6$, resulting from the hydrolysis of the orthoplumbate; the calcium hydroxide is extracted by washing with water free from carbonic anhydride; the residual diplumbate is yellow, and relatively stable towards acids. On one occasion, by the action of dilute nitric acid on the diplumbate, hydrogen calcium triplumbate, $H_2CaPb_3O_8$, was formed as a greyish-brown powder resembling the diplumbate in general properties. Both compounds decompose suddenly at a definite temperature into oxygen and lead dioxide. Attention is called to the analogy between the highest oxidation products of lead, silicon, and carbon, which is emphasised by the discovery of these complex acids of lead. J. B. T.

Volatility of Mercuric Chloride. By H. Arctowski (*Zeit. anorg. Chem.*, 1894, **7**, 167—175).—The author shows that mercuric chloride is decidedly volatile at the ordinary temperature, and has also determined the volatility at various temperatures from 56° to 125°, keeping the other conditions constant. Taking the temperatures as abscissæ, and the amounts of chloride volatilised as ordinates, a curve is obtained for the relative volatility which is asymptotic to the temperature-axis. E. C. R.

Cerium Compounds. By L. M. Dennis and W. H. Magee (*Zeit. anorg. Chem.*, 1894, **7**, 250—264).—The authors, having obtained considerable quantities of allanite, intend to carefully investigate the derivatives of cerium. For the separation of cerium from the other earths of this group, the best method is a modification of Debray's fusion with potassium nitrate (Abstr., 1883, 713). When employing potassium nitrate, the fusion point of the mixed nitrates is about 325°, and at this temperature traces of didymium nitrate are always decomposed, so that the insoluble cerium oxide left after treatment of the melt with water always contains didymium. The authors substitute a mixture of potassium and sodium nitrates in molecular proportion for the potassium nitrate. Such a mixture melts at 231° (Carnelly and Thomson, Trans., 1888, 792). By this means the melting point of the mixed nitrates was reduced below 230°, and the decomposition could be carried out at 300°. No didymium nitrate was then decomposed, and the cerium oxide obtained after each fusion was free from impurity.

After trial of the various qualitative tests for cerium, the authors recommend Cleve's (Abstr., 1885, 635) and Boisbaudran's (*ibid.*) method of adding excess of ammonia, and then hydrogen peroxide, to the solution. The orange precipitate or coloration can be detected with as little as 0·005 milligram of cerium oxide.

In attempting to obtain a tetrachloride by saturating with dry chlorine, at a low temperature, a concentrated hydrochloric solution of cerium oxide, a *chloride*, $CeCl_3,7H_2O$, was obtained; the same salt was formed when a stream of dry hydrogen chloride was substituted for the chlorine. The salt forms orthorhombic crystals showing the axial ratios $a : b : c = 0·80834 : 1 : 1·44187$. It loses part of its water of crystallisation in a vacuum over dehydrating agents, but is stable in the air. It appears to be different from the salt, $2CeCl_3,15H_2O$, already known.

Cerous hydroxide when pure is white, but when moist readily absorbs oxygen, becoming first purple and then yellow, the latter coloured substance yielding, on ignition, ceric oxide. The purple hydrate is undoubtedly in an intermediate stage of oxidation.

L. T. T.

Nitrogen Compounds of Manganese. By O. Prelinger (*Monatsh.*, 1894, **15**, 391—401).—*Pentamanganese nitride*, Mn_5N_2, and *trimanganese nitride*, Mn_3N_2, are obtained on passing nitrogen and ammonia respectively over finely-divided manganese, heated to redness in a hard glass tube. The former has a dull, metallic lustre, and, when finely divided, is somewhat darker than powdered manganese. On heating in a stream of hydrogen, ammonia is formed, whilst if hydrogen sulphide is substituted for the element, ammonium sulphide results. On treatment with ammonium chloride solution, ammonia, hydrogen, and the double chloride of manganese and ammonium are obtained, and on fusion with caustic alkali much ammonia is liberated. The compound, Mn_3N_2, forms a darker powder, but otherwise closely resembles the substance previously described. The author points out that the constitution of the two compounds may be explained by assuming the nitrogen to be pentavalent in the case of the pentamanganese nitride, and trivalent in that of the trimanganese nitride.

G. T. M.

Manganese Steel. By H. Le Chatelier (*Compt. rend.*, 1894, **119**, 272—274).—The manganese steel discovered by Hadfield is practically non-magnetic, and has a higher resistance than any other alloy of iron. Moreover, it is more malleable, the more highly it has been tempered. Hadfield has found that an allotropic modification, which is magnetic, can be obtained by heating the ordinary manganese steel at a high temperature for several days.

The author finds that the change from non-magnetic to magnetic metal takes place between 500° and 650°, and, at the most favourable temperature, 550°, the change is complete in an hour or two. In order to convert the magnetic metal to the non-magnetic, it must be heated at a temperature not lower than 800°, and must be cooled somewhat rapidly in order to prevent the reverse change between 500° and 600°. Since the rate of this latter change is very low, ordinary cooling in air is usually sufficient.

The electrical resistance of a wire, 1 mm. long and 1·4 mm. diameter, is as follows.

	Temperature	15°	90°	300°	500°	635°	730°	850°	965°	1020°
Resistance	non-magnetic	1·06	1·19	1·44	1·65	—	—	1·88	—	1·97
	magnetic	0·88	0·99	1·27	1·50	1·7	1·79	—	1·93	1·97

The two curves touch at 740°, and coincide above this temperature, and hence this is the temperature of transformation of the two varieties of metal. This temperature is, however, also that at which soft iron becomes non-magnetic. It would seem, therefore, that manganese steel is a mixture of iron with a definite compound of iron and manganese, the latter being non-magnetic under any conditions. The iron undergoes the normal changes, but they take place more slowly, in consequence of the presence of the manganese compound.

The expansion of the two varieties of manganese steel is the same, and hence it would follow that there is no change of dimensions at the point of transformation. The following table gives the expansion of a rod 100 mm. long.

Temperature..	230°	500°	680°	830°	990°	1060°.
Expansion....	0·35	0·67	1·05	1·43	1·97	2·09 mm.

Manganese steel tempered in water shows, at once, when annealed, a definite contraction of 0·4 mm. on 100 mm. C. H. B.

Chemical Behaviour of Arsenical Pyrites. By T. M. Lightfoot (*J. Amer. Chem. Soc.*, 1894, **16**, 624—633).—The author has tried the action of solutions of potassium permanganate, of different strengths and at different temperatures, on arsenical pyrites, and has tabulated the results. Potassium permanganate partially oxides the sulphur, but even at the boiling heat nothing like a complete oxidation takes place. The sulphur oxidised was estimated in the filtrate by the usual process.

Hydrogen chloride at a high temperature does not expel large quantities of sulphur, but removes considerable amounts of arsenic. In these experiments, the sulphur left in the boat was oxidised in the ordinary way, and deducted from the total sulphur, the difference being the sulphur volatilised.

Solution of copper sulphate under pressure dissolved but little ferrous iron, which goes to prove that the mineral contains the iron in the ferric state. A little green copper arsenate was also formed in the reaction. L. de K.

Action of Ferric Sulphate on Potassium Iodide and Hydriodic acid. By K. Seubert and R. Rohrer (*Zeit. anorg. Chem.*, 1894, **7**, 137—153).—The action between ferric sulphate and potassium and hydrogen iodides takes place in a manner very similar to that described by Seubert and Dorrer for ferric chloride (Abstr., 1894, ii, 191). The reaction with one equivalent of ferric sulphate, $\frac{1}{2}Fe_2(SO_4)_3$, and varying proportions of potassium iodide, approaches the theoretical when 20 mols. of potassium iodide are present. The yield is then 97 per cent., and any further increase in the proportion of potassium iodide produces no increase in the amount of free iodine. When the results are compared with those obtained with ferric chloride, it is evident that the action is much slower, and for small excesses of potassium iodide is never so complete. The results obtained with the proportion $FeCl_3 : KI$ correspond with those obtained with the proportion $Fe_2(SO_4)_3 : 4KI$. When the action is allowed to proceed for 18 hours, using an equivalent of ferric sulphate, and varying proportions of potassium iodide, the amount of iodine liberated is at first much less than the amount liberated when ferric chloride is used, but the difference becomes small for 6 mols. KI, and disappears for 10 mols.

With 1 mol. of potassium iodide and varying proportions of ferric sulphate, the action is also much slower than with ferric chloride; and the numbers obtained with the proportions $2KI : 4Fe_2(SO_4)_3$

and 2KI : $10Fe(SO_4)_3$ agree with those obtained for the proportions KI : $FeCl_3$ and KI : $2FeCl_3$ respectively.

The action between ferric sulphate and hydrogen iodide is also slower and less complete than that between ferric chloride and hydrogen iodide.

It is evident that the reaction $Fe_2(SO_4)_3 + 2KI = 2FeSO_4 + K_2(SO_4) + I_2$ is a reversible one when none of the products are removed from the sphere of action. And experiments with mixtures containing various molecular proportions of ferrous sulphate potassium iodide, iodine, and potassium sulphate, after remaining 144 hours, always contained an amount of iodine corresponding with that liberated by an equivalent mixture of ferric sulphate and potassium iodide. E. C. R.

Attempt to prepare Molybenum Hexachloride. By E. F. SMITH and H. C. BURR (*J. Amer. Chem. Soc.*, 1894, **16**, 577—578).—The authors thought that if a partially chlorinated molybdic acid were exposed to chlorinating agents, the residual oxygen might be removed, and that then perhaps the hexachloride might be obtained as a final product. To this end, molybdenyl chloride, MoO_2Cl_2, was mixed with an equivalent quantity of phosphorus pentachloride, and heated in a sealed tube, in the presence of chlorine, at 170°. On cooling, it was found that the tube contained a mass of greenish-black crystals; these, when freed from phosphorus oxychloride by distillation in a current of chlorine, yielded a product which, on analysis, gave figures approximating more to the pentachloride than to the hexachloride. The experiment was repeated, silicon tetrachloride being substituted for the phosphorus compound. The crystalline product was quickly removed to a boat, and distilled in an atmosphere of carbonic anhydride. The brown vapours condensed in the colder portions of the tube, and on analysis gave results varying between those required by the tetrachloride and pentachloride.

The authors have not, however, given up all hope of preparing the hexachloride. They have observed that metallic molybdenum rapidly acts on ferric chloride solution with reduction of the ferric salt, and dissolves as a hexad. Further experiments will be made to get it in the solid state. L. DE K.

Salts of Sulphomolybdic acid. By A. ROSENHEIM (*Zeit. anorg. Chem.*, 1894, **7**, 176—184).—The salts described in this communication have been previously prepared by Péchard (Abstr., 1893, ii, 530). The author confirms the results previously obtained as to their properties; but his analytical results do not agree with the composition of the salts assigned to them by Péchard. The ammonium salt has the composition $3(NH_4)_2O,2SO_2,8MO_3 + 5H_2O$, the potassium salt is $4K_2O,4SO_2,9MO_3 + 5H_2O$, whilst the sodium salt has the composition $9Na_2O,8SO_2,20MO_3 + 37H_2O$. E. C. R.

Complex Inorganic Acids. By V. ALVISI (*Gazzetta*, 1894, **24**, i, 523).—On warming phosphomolybdic acid with hydrofluoric acid solution, the yellow colour disappears, and the solution no longer gives a precipitate with ammonium nitrate; on concentration, the yellow colour reappears, and ammonium nitrate then precipitates the salt $MoO_3,2NH_4F$.

Ammonium phosphomolybdate, when warmed with concentrated hydrofluoric acid, yields monammonium fluoroxymolybdate (compare Mauro, Abstr., 1891, 18).

Neutral potassium fluoroxymolybdate is deposited on mixing solutions of potassium hydrogen fluoride and phosphomolybdic acid. Ammonium fluoride acts on ammonium phosphomolybdate with formation of the salt MoO_2,NH_4F, and on phosphomolybdic acid, giving the salt $MoO_3,2NH_4F$ and normal ammonium fluoroxymolybdate $MoO_2F_2,2NH_4F$. W. J. P.

A New Oxysulphide of Tin. By F. W. Schmidt (*Ber.*, 1894, **27**, 2739—2743).—When stannic sulphide, obtained in the usual way by the action of hydrogen sulphide on a solution of stannic chloride, is allowed to remain in contact with ammonia, it dissolves, forming a solution, which, on acidification, yields a very voluminous white precipitate. The same substance may be obtained by digesting stannic sulphide with ammonium carbonate solution, filtering, and acidifying; about 10 per cent. of the stannic sulphide is dissolved.

This compound when freed from sulphur by treatment with carbon bisulphide, has the composition $Sn_2S_3O + 11H_2O$, is easily and completely soluble in ammonium carbonate, and is also slowly soluble in water. When dried, the white mass gradually loses its property of dissolving in ammonium carbonate solution, and becomes amber-yellow, but, even after preservation for a year, this yellow mass dissolves readily in ammonia, and the solution thus obtained deposits the white compound when excess of acid is added.

The partial solubility of stannic sulphide in ammonium carbonate solution is of great analytical importance, as this reagent is often used to separate the sulphides of tin and arsenic. A. H.

New Method of Extracting Gold from Auriferous Ores by means of Bromine. By C. Lossen (*Ber.*, 1894, **27**, 2726—2727).—Hitherto bromine has not been used for this purpose, as it could not be readily recovered, and the cost of the process was consequently too great. The author electrolyses a solution of potassium bromide, and obtains an alkaline solution which contains hypobromite and bromate, and which is capable of dissolving gold. The ore is treated with excess of this solution in rotating cylinders, the solution is then filtered, the gold is precipitated by passage over a mixture of iron and coal, and the solution, which now contains mainly potassium bromide, is electrolysed and again used for extraction. C. F. B.

Mineralogical Chemistry.

Native Iron. By G. C. Hoffmann (*Zeit. Kryst. Min.*, 1894, **33**, 507; from *Ann. Rep. Geol. Surv., Canada*, **5**, part R).—Native iron occurs as a constituent of a thin crust of oolitic structure on quartzite on the north shore of St. Joseph's Island, Lake Huron, Ontario. An analysis of the crust gave

Metallic grains.	Limonite.	Siliceous matter.
58·85	39·73	1·42

The metallic spherules varied from microscopic minuteness to a diameter of 0·37 mm., and gave the following results on analysis.

Fe.	Mn.	Ni.	Co.	Cu.	S.	P.	Insoluble.
88·00	0·51	0·10	0·21	0·09	0·12	0·96	9·76

From this, the author concludes that the metallic portion of these grains contains 97·79 per cent. of iron, and that they were formed by reduction of an iron salt by means of an organic material.

B. H. B.

Mineral Wax from Kaluga. By W. Alexéeff (*Jahrb. f. Min.*, 1894, ii, Ref. 231; from *Verhand. russ. kais. min. Ges. St. Petersburg*, **29**, 201—203).—This new substance, presenting the external characteristics of ozokerite, was found in the peat of the Russian province of Kaluga. It is almost insoluble in alcohol and benzene. Its sp. gr. is 0·950, and its melting point between 64° and 65°. Analysis yielded

C.	H.	O.
75 5	12·5	12·0

On distillation, water was formed and a liquid with a sp. gr. of 0·786, and a boiling point of 240°; analysis gave C = 83·4; H = 13·8 per cent.

B. H. B.

Grahamite from Texas. By E. T. Dumble (*Zeit. Kryst. Min.*, 1892, 1894, **33**, 509; from *Trans. Amer. Inst., M.E.*, **21**, 601—605).—Grahamite, an asphalt-like substance, occurs in thin veins and in masses in the tertiary rocks near Webb Bluff, on the Rio Grande (I), and at O'Quinn and Buckner's Creeks (II). Analyses gave the following results.

	H_2O.	Volatile matter.	Fixed carbon.	Ash.	Total.
I.	0·30	44·00	52·80	2·90	100·00
II.	—	57·90	37·70	4·40	100·00

	C.	H.	N.	O.	S.	Ash.	H_2O.
I.	78·65	7·50	0·15	5·08	5·42	2·90	0·30
II.	76·19	6·61	0·39	5·15	7·45	4·21	—

B. H. B.

Chemical Constitution of Iron Pyrites. By J. Loczka (*Zeit. Kryst. Min.*, 1894, **33**, 501).—Seeing that an identical anhydrous ferric sulphate, $Fe_2(SO_4)_3$, is obtained on treatment with concentrated boiling sulphuric acid, both from iron pyrites and from ferrous compounds, the author concludes that iron pyrites is a ferrous compound. This view is supported by the fact that, on weathering, iron pyrites is decomposed into ferrous sulphate and sulphuric acid. The formula of iron pyrites should therefore be $Fe<\begin{matrix}S\\|\\S\end{matrix}$. B. H. B.

Andorite, a New Hungarian Silver Ore. By J. A. Krenner (*Zeit. Kryst. Min.*, 1894, **33**, 497—499).—This new and rare mineral was found with antimonite, quartz, and zinc-blende in the main vein at Felsöbánya. It is a dark, leaden-grey to black mineral, crystallising in the rhombic system, and yielding on analysis the following results.

Sb.	S.	Pb.	Ag.	Cu.	Fe.	Insoluble.
41·91	23·32	22·07	11·31	0·69	0·70	0·04

The formula is $Sb_6S_{12}Pb_2Ag_2$. B. H. B.

Preparation of Artificial Anatase and Rutile. By B. Doss (*Jahrb. f. Min.*, 1894, ii, Mem., 147—206).—Shortly after G. Rose's announcement, in 1867, that tabular anatase was formed by saturating a microcosmic salt bead with artificial or with natural titaniferous acid, a correction was made by A. Knop, who stated that the crystals in question contained phosphoric acid, and had a sp. gr. of only 2·9. Further, G. Wunder showed that besides phosphoric anhydride, sodium was also present. In the course of an investigation of the alteration products of a Saxon syenite, the author found it necessary to compare undoubted specimens of anatase and of rutile. For this purpose, artificial material was required, and the author obtained artificial rutile by G. Rose's method of saturating a borax bead with titanic anhydride. His experiments, made with the object of obtaining anatase with a microcosmic salt bead, were successful, but with a borax bead the results were negative. Rutile, on the other hand, could be obtained in either case. B. H. B.

New Tin Mineral from the Black Hills. By T. Ulke (*Zeit. Kryst. Min.*, 1894, **33**, 509; from *Trans. Amer. Inst.*, *M.E.*, 1892, **21**, 240).—At the Etta Mine, in the Black Hills of Dakota, there occurs in quartz veins a yellowish, earthy substance, accompanied by cassiterite. It contains 60 per cent. of tin, 12 per cent. of copper, and 8 per cent. of water. The author assigns to it the formula $4SnO_2 + Cu_2Sn(OH)_6$, and the name of *cuprocassiterite*. The mineral has, however, been investigated also by W. P. Headden (*Amer. J. Sci.*, 1893, [3], **45**, 105), who considers it to be a mixture due to the decomposition of tin pyrites. B. H. B.

Nickel Arsenide. By E. Waller and A. J. Moses (*School of Mines Quarterly*, 1892, **14**, 49—51).—A probably new nickel arsenide was found at a mine 18 miles west of Silver City, New Mexico. Its composition was found to be as follows.

SiO_2.	Pb.	Ag.	As.	Ni.	Co.	Fe.
4·56	trace	8·38	67·37	11·12	5·13	2·64

This corresponds with the formula RAs_3, in which R represents $\frac{4}{7}$Ni, $\frac{2}{7}$Co, and $\frac{1}{7}$Fe. The mineral is thus of the type of skutterudite $CoAs_3$. B. H. B.

Apatite in a Laminated Graphite from Ceylon. By P. Jannasch and J. Locke (*Zeit. anorg. Chem.*, 1894, **7**, 154—157).—The apatite occurred as an ellipsoidal mass about the size of a walnut, and is of a beautiful, green colour. Analysis gave

P_2O_5.	Al_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.
39·84	2·02	0·62	0·22	53·36	0·25	0·52	0·42

H_2O.	Cl.	F.	Total.
0·48	1·82	1·03	100·58

This agrees with the formula $P_3O_{12}(F,Cl,OH)Ca_5$. E. C. R.

Svabite and Adelite. By H. Sjögren (*Jahrb. f. Min.*, 1894, ii, Ref., 237—238; from *Bull. geol. inst. univ. Upsala*, **1**, 1).—The author gives two analyses of svabite from the Harstig Mine and from the Jakobsberg Mine, near Nordmarken. The mineral occurs in granular hausmannite in yellowish-white to colourless masses. The formula deduced from the analyses is $3As_2O_5,9CaO,CaF_2$.

Analyses of adelite from the Kittel Mine, from Moss Mine, and from Jakobsberg Mine gave results agreeing with the formula $HO{\cdot}MgCaAsO_4$, in which calcium is partially replaced by lead, manganese, and iron. B. H. B.

Fergusonite from Ceylon. By G. T. Prior (*Min. Mag.*, **10**, 234—238).—Accompanying the baddeleyite of Rakwana, in Ceylon, fragments of so-called yttrotantalite were found. The sp. gr. was 4·54 to 5·49, the hardness 5 to 6, and the colour dark brown. The mineral is very brittle, isotropic, and translucent, with yellowish-brown colour, in thin fragments. Analysis yielded the following results.

Nb_2O_5.	Ta_2O_5.	UO_3.	Y_2O_3.	Er_2O_3.	CaO.	Fe_2O_3.	H_2O.	Total.
44·65	4·98	5·11	24·67	13·24	2·02	0·51	4·58	99·78

The mineral is thus fergusonite, and resembles in all its characters the fergusonite of Ytterby. B. H. B.

Crystallochemical Theory of the Silicates. By F. J. Wiik (*Zeit. Kryst. Min.*, 1894, **33**, 379—450).—The author propounds an elaborate theory of the relation between the chemical and crystallographical characters of the silicates. On the basis of this theory, he gives the following crystallochemical classification of the silicates.

Class I. *Geolites.*—1. Plagioclase (anorthite, andesine, albite); microcline, orthoclase; spodumene, petalite, wollastonite; danburite, leucophane, melinophane. 2. Scapolite (gehlenite, sarcolite); nepheline (cancrinite, davyn), milarite. 3. Leucite; sodalite (nosean, hauyn).

Class II. *Hydrogeolites* (Zeolites).—1. Datolite, prehnite; desmine (harmotome, phillipsite), heulandite (brewsterite, epistilbite); scolezite, natrolite (mesolite), thomsonite; laumontite (leonhardite); okenite (pectolite). 2. Apophyllite; chabasite (gmelinite, levyn, herschelite). 3. Analcime, faujasite, pollux.

Class III. *Phyllites.*—1. Muscovite (paragonite, margarite, lepidolite), biotite (meroxene, phlogopite, zinnwaldite), clintonite; clinochlore (pennine); talc, serpentine; pyrophyllite, kaolin. 2. Biotite (in part); prochlorite.

Class IV. *Amphoterolites.*—1. Axinite; epidote (piemontite), orthite (mosandrite), karpholite (ardennite), zoisite (thulite); gadolinite (homilite), euclase; cordierite (pinite). 2. Tourmaline, cappelenite (melanocerite, karyocerite, tritomite), eudialyte; idocrase (melilite). 3. Garnet, helvine.

Class V. *Stylolites.*—1. Sapphirine, cyanite, dumortierite, andalusite (sillimanite, xenolite), staurolite; topaz, bertrandite. 2. Beryl; thorite (orangite), zircon. 3. Zunyite.

Class VI. *Metallolites.*—1. Rhodonite, babingtonite, pyroxene (malacolite, diallage, diopside, augite), acmite (aegirine), woehlerite; amphibole (tremolite, grammatite, amphibole-anthophyllite, hornblende), arfvedsonite; titanite, guarinite, lièvrite; olivine (forsterite, hyalosiderite, fayalite, tephroite), monticellite, chondrodite (humite, klinohumite); calamine, cerite. 2. Willemite (troostite), phenacite, dioptase; pyrosmalite. 3. Eulytine. B. H. B.

Orthoclase from Canada. By B. C. Hinman (*School of Mines Quarterly*, 1892, **14**, 52).—A fine, cleavable felspar from 30 miles from Buckingham, Ottawa Co., Province of Quebec, yielded

SiO_2.	Al_2O_3.	K_2O.	CaO.	Na_2O.
65·87	19·32	11·78	0·64	2·39

B. H. B.

Neptunite, Epididymite, Katapleite and Ægirine from Greenland. By G. Flink (*Zeit. Kryst. Min.*, 1894, **33**, 344—367).—The author describes an interesting series of minerals from Greenland, the locality where they were obtained being thought to be in the vicinity of Julianehåb, in syenitic pegmatite veins. The minerals described are (1) neptunite, (2) epididymite, (3) katapleite, a mineral hitherto known only from Langesund, in Norway, and (4) ægirine, the mineral of most frequent occurrence at this new locality.

The new mineral, *neptunite*, occurs in monosymmetrical crystals, and has the following composition.

SiO_2.	TiO_2.	FeO.	MnO.	CaO.	K_2O.	Na_2O.
51·93	17·45	10·23	5·32	0·71	5·71	9·36

The composition of the new mineral, *epididymite*, is identical with that of the mineral eudidymite, discovered by Brögger, in Norway, and may be represented by the formula Si_3O_8BeNaH. The crystals of eudidymite are, however, monosymmetrical, whilst those of epididymite are rhombic. B. H. B.

Physiological Chemistry.

Percentage of Nitrogen in Red Blood Corpuscles in Health and Disease. By R. v. Jaksch (*Chem. Centr.*, 1894, i, 782; from *Zeit. Klin. Med.*, **24**, 429—440).—100 grams of healthy blood contains 22·6 grams of proteïd; in anæmia, this may sink to 10; the two factors concerned in this fall are the corpuscles and the plasma. 100 grams of red blood corpuscles contains in health 5·52 grams of nitrogen, corresponding with 34·5 grams of proteïd. In acute disease, the nitrogen may rise to 5·89, and in chronic diseases, not associated with anæmia, to 5·56. In pernicious anæmia, it may rise to 6·48, corresponding with 40·5 grams of proteïd; but other forms of anæmia, especially chlorosis, show a great diminution in the nitrogen of the red corpuscles. In leucæmia, the same is true. W. D. H.

The Blood in Anæmia. By E. Biernacki (*Chem. Centr.*, 1894, i, 781—782; from *Zeit. Klin. Med.*, **24**, 460—511).—The investigation relates more particularly to the mineral constituents of the blood in various forms of anæmia, especially that produced by infectious diseases like typhoid and pneumonia. Anæmic blood contains more sodium and water, and less potassium, phosphorus, and iron, than healthy blood. The numbers given in regard to the sodium chloride are:—Healthy blood contains 0·441 to 0·468 per cent. of sodium chloride. In pathological blood, this number fell to 0·374—0·366, or rose to 0·509—0·653; the cases where the rise was noted were strongly hydræmic. The excretion of the salt in the alimentary tract and urine does not, however, vary. W. D. H.

Sugar in the Blood after Bleeding. By F. Schenck (*Pflüger's Archiv*, 1894, **57**, 553—572).—Claude Bernard originally stated that loss of blood caused a rise of sugar in the residual blood. This was confirmed by v. Mering, and also in the present research, where a new method (removal of proteïds by mercuric chloride, and subsequent titration by Knapp's method) was employed. The rise of sugar begins immediately after bleeding, but cannot be recognised a few hours after. The source of the sugar is apparently the liver, as the rise does not occur if the liver is cut off from the circulation; it is more marked when ammonium carbonate is given, this drug stimulating glycogenesis, and is diminished by glycenol, which inhibits the change of glycogen into sugar. W. D. H.

Formation of Sulphuric acid in the Organism. By W. J. Smith (*Pflüger's Archiv*, 1894, **57**, 418—426).—A number of new experiments are recorded which, together with those previously published, show that mercaptans like thio-acids are decomposed in the organism, and lead to an increase of sulphuric acid in the urine. Ethyl mercaptan is decomposed differently inside and outside the body, the union between sulphur and carbon being in the former case dissolved, in the latter not. The explanation of such a difference is postponed.

W. D. H

The Leucine of the Pancreatic Fermentation. By R. COHN (*Ber.*, 1894, **27**, 2727—2732).—Leucine, obtained by fermenting blood-fibrin with calves' pancreas, was not found to melt and partially sublime at 170°, as stated in all text-books; it melted and decomposed at 275—276°. This is about the melting point (under pressure) of inactive leucine, but the new modification differs from the latter in its greater solubility in water, in being feebly lævorotatory, and in the fact that it is completely destroyed by *Penicillium glaucum*. It is also more soluble in water than the pancreas-leucine hitherto described. The author suggests that not one leucine, but a series of such, is formed in the pancreatic fermentation.

C. F. B.

Peptone in Urine. By W. ROBITSCHEK (*Chem. Centr.*, 1894, i, 780; from *Zeit. Klin. Med.*, **24**, 542—604).—Peptonuria is found in many diseases, especially during suppuration, and also in phosphorus poisoning. Devoto's method is recommended for its detection.

W. D. H.

Behaviour of the Aromatic Hydroxy Ketones in the Animal Organism. By M. NENCKI (*Ber.*, 1894, **27**, 2732—2736).—When resacetophenone is administered to dogs, their urine is found to contain resacetophenone-sulphuric acid and glycuronic acid. *Potassium resacetophenonesulphate* crystallises in white needles, and, by gentle warming with hydrochloric acid, is decomposed into resacetophenone and sulphuric acid. The free *acid* also forms white needles, and may be recrystallised from alcohol.

Parahydroxypropiophenone undergoes a similar change, but the corresponding acids have not been isolated. These hydroxyl-compounds therefore differ from acetophenone itself, which is converted into benzoic acid by oxidation in the system, and is excreted in the form of hippuric acid.

A. H.

Chemistry of Vegetable Physiology and Agriculture.

The Separation of Oxygen by Cells containing Chromophyll. By T. W. ENGELMANN (*Pflüger's Archiv*, 1894, **57**, 375—386).—In these researches, the bacterial method was employed, and the results, which are illustrated by coloured figures, were as follows.

Green plant cells give off oxygen in the light, the amount within wide limits varying with the illumination. The bacteria used need free oxygen for their movements, and within wide limits the amount of movement varies with the amount of oxygen. In cells with chromophyll granules, this test shows that the granules are the source of the oxygen; colourless protoplasm, cell membrane, and nucleus are not. Red light, which is that most absorbed by chlorophyll, leads to the greatest development of oxygen. The green pigment is not itself capable of so acting; it must be present in connection with the living strome of the chlorophyll granule. Other chromophylls act similarly. W. D. H.

Hydrogen Peroxide in Green Plants. By A. BACH (*Compt. rend.*, 1894, **119**, 286—288).—The author has investigated the applicability of the various reagents for hydrogen peroxide to the detection of this substance in the leaves of green plants or the extract from them.

Tetramethylparaphenylenediamine is coloured by calcium chloride and by glycerol owing to their absorption of oxygen, and is also affected by nitrous acid; on this account the results obtained are always open to question. Tincture of guaiacum in presence of diastase is difficult to use, and the results are uncertain. Potassium iodide and starch in presence of ferrous sulphate is affected by any unsaturated substances that can absorb iodine, and such substances are always present in the leaf extract. Titanic oxide dissolved in sulphuric acid gives, with tannin, the same coloration as with hydrogen peroxide, and tannin is always present in leaf extract. Uranium acetate is precipitated by albumin and by tannin, and the turbidity does not completely disappear on adding acetic acid. Potassium dichromate and ether is never very sensitive, and is much less sensitive in presence of a solution of tannin or an extract of leaves.

It follows that none of the ordinary reagents for hydrogen peroxide yield satisfactory results when applied to leaves or an extract of leaves. C. H. B.

Formation of Substance in Sea Algæ. By A. HANSEN (*Bied. Centr.*, 1894, **23**, 544—545; from *Naturw. Rundsch.*, 1893, 73.).—The *Phæophyceæ* (especially *Dictyoma*) do not produce starch but fat. The substance found in the cells of the inner cell-layer of the thin sprouts, which Berthold supposed to be albuminous, gives the microchemical reaction of fat. The cells serve as a storing place for the fat which is produced in the assimilative tissues. Fat was also found in *Taonia atomaria* and in *Halyseris polypodioides*, whilst oil could be detected in *Asperococcus hydroclathrus* and in *Cystoseira*. The production of substance in the *Florideæ* seems to be more complicated. The cells of the assimilative tissues of *Chondriopsis cœrulescens* contain a globular substance which reflects light in a peculiar manner, and, according to Kny, gives rise to the iridescence of this plant. Inasmuch as no oil or starch, &c., could be found in the cells, this substance is probably a food. It swells up in water, dissolves in alcohol, and becomes dark (but not black) when treated with osmic acid, and brown when treated with iodine.

A starch-like substance was only found in *Gracilaria* (a small species of *Florideæ*).

An examination of the dyes of sea algæ indicated that the red colour of the *Florideæ* is the albumin compound of a dye, like hæmoglobin. The green colour of the *Florideæ* can be separated into a yellow dye, and a green dye, probably ordinary chlorophyll. Many of the *Florideæ* are almost green, and these grow near the surface; the deeper-growing ones increase in redness the deeper they occur. It is assumed that the red dye absorbs the dissolved oxygen of the water. N. H. M.

Physiological Meaning of the Cyanic Colouring Matters. By L. Kny (*Bied. Centr.*, 1894, **23**, 546—547; from *Naturw. Rundsch.*, 1893, 620).—According to Kerner, the object of the cyanic colouring matters is to protect the chlorophyll in young organs by shading from the light, or, on the underside of leaves, to convert light rays into heat rays. In stems and leaf veins, Pick and Kerner connect their presence as screens with the movement and decomposition of plastic substances.

An alcoholic chlorophyll solution was exposed to light which first passed through a red extract of *Beta vulgaris* (*var. rubra*), and through a white extract of *B. vulgaris* (*var. rapa*) respectively. It was found that the red solution did delay the decomposition of the chlorophyll, as the solution kept under the white extract was first changed.

As regards the transformation of light rays into heat by the colouring matters, it was found that when the leaves of beech, hazel, barberry, maple, cabbage, *Dracaena ferrea*, *Canna indica*, and beet, were exposed to sun light previously passed through alum solution, the temperature of the vessels containing red leaves became higher than in the case of green or white leaves. The greatest difference was 4°. When the direct light was cut off, the vessels containing the red leaves cooled first, the temperature of both vessels becoming about equal in 10 or 20 minutes. N. H. M.

Presence of Several Distinct Chlorophylls in the Same Vegetable Species. By A. Étard (*Compt. rend.*, 1894, **119**, 289—291). See this vol., i, 66.

Calcium Citrate in Plants. By C. Wehmer (*Ann. Agm.*, 1894, **20**, 391; from *Ber. deut. bot. Ges.*, 1893, 333).—After calling attention to the very sparing solubility of calcium citrate in water, the author suggests that some of the crystalline deposits in plants (such as the raphides and some sphero-crystals), hitherto supposed to be calcium oxalate, may be citrate. Citric acid has a rôle in respiration; it is by no means demonstrated that all the carbonic anhydride liberated during respiration is produced from albumin, and it seems more likely that acids containing large amounts of oxygen may undergo complete combustion. N. H. M.

Nutrition of Plants by Humus and Organic Substances. By E. Bréal (*Ann. Agron.*, 1894, **20**, 353—370).—A large portion of the paper is a *résumé* of experiments hitherto made on vegetation, without any organic matter, with humus substances and stable manure, water culture experiments with mineral salts and calcium humate, and experiments on the direct absorption of organic matter by plants. Although there was no doubt as to the beneficial effect of humus on plants, there was no evidence to show that the humus was directly absorbed, excluding the possibility of the intervention of lower organisms.

In the first experiment now described, a tuft of grass (*Poa annua*) was taken from the soil, the roots cut off and fresh roots obtained by water culture. The tuft was next divided into two equal parts, the one placed in a dish of potassium humate (carefully prepared from soil), whilst the roots of the other portion, after cutting off the tops, were placed in a similar vessel containing the same amount of potassium humate solution. In two or three days the roots of the whole plants entirely removed the potassium humate, the bottom of the dish being perfectly white; whilst the roots alone in the other dish seemed to have had no effect, the liquid being as dark as at first. On filtering the two liquids and estimating the carbon, the liquid which had contained the entire plants gave only 0·005 gram of carbonic anhydride, the other 0·025 gram. The potassium humate, had, therefore, been directly absorbed by the plants.

Other experiments are described confirming this result. The roots of *Poa* left in water over a filter paper covered with potassium humate, adhered tightly to the paper, leaving marks, when removed, resembling those which Sachs obtained by the corroding action of roots on marble. When trefoil plants and roots respectively were kept in solutions of sodium humate, the results obtained were similar to those with *Poa* and potassium humate.

Finally, an experiment is described in which the roots of entire plants (*Poa annua*), suspended in a solution containing sugar, completely absorbed the sugar, whilst the roots alone of similar plants did not. In this case, again, the absorption must have been direct, without the intervention of lower organisms. N. H. M.

Agricultural Value of Various Natural Phosphates. By G. Paturel (*Ann. Agron.*, 1894, **20**, 316—348).—The natural phosphates of various places, especially those of Brittany, have various commercial values attributed to them which do not always correspond with the effect produced by them on crops. The object of the present investigation was to ascertain why the phosphate of the green-stone (Boulonnais) are preferred to those of the Somme.

The employment of ammonium citrate or oxalate for the estimation of available phosphoric acid, does not give trustworthy results when applied to natural phosphates. Weak acids, such as acetic acid (Dehérain) or citric acid (Dyer), seem much more likely to give good results, as their action is comparable with both that of the acid of the soil and of root sap.

The results of the author's experiments on the action of dilute citric acid on the two phosphates in question, show, in the first place, that a 10 per cent. solution of citric acid dissolved very much more than a 1 per cent. solution. The amount of phosphates dissolved depended, however, on the amount of lime present when the results obtained with acid solution of a particular strength are compared. Thus, a Somme phosphate (with 24 per cent. total phosphoric acid and 13·8 per cent. of lime) gives up a smaller percentage of phosphoric acid than the Boulonnais phosphate (with 19 per cent. of total phosphoric acid and 7·6 per cent. of lime). Calcium carbonate seems to have a special retarding effect on the solvent action of the acid. This is not due merely to the neutralisation of the acid by the lime, as the differences in the amounts dissolved from the two phosphates were almost the same, whether 10, 5, 2, or 1 per cent. solutions were employed. In the case of a chalky phosphate (phosphoric acid 16·24, lime 57·2 per cent.), practically no phosphoric acid (less than 1 per cent.) was dissolved. In this case, the 1 and 2 per cent. acid solutions hardly showed an acid reaction after 24 hours.

The next experiments were made with acetic acid. Except that acetic acid is a much feebler solvent for the phosphate than is citric acid, the results were similar.

The effect of carbonic anhydride alone, in conjunction with citric acid, and with acetic acid respectively, was also examined. Carbonic anhydride alone dissolved very little of the phosphate, and did not have any marked effect when employed with acetic or citric acid. In a subsequent experiment, however, in which the phosphates had been kept for some time in water containing carbonic anhydride, then extracted with 10 per cent. acetic acid solution, a considerably higher percentage of phosphoric acid was dissolved, doubtless because a part of the lime had been dissolved by the carbonic anhydride.

The results of the experiments showing that the Boulonnais phosphate was more soluble in citric acid than the Somme phosphate is in accordance with the known effect of the two manures in agriculture.

In estimating the value of mineral phosphates, the quantity of lime as well as that of phosphoric acid (soluble in dilute acid) should be determined. In the case of such phosphates as those of the Somme, it would probably be worth while to remove part of the lime before applying them to the land. This is, however, a point to be decided by direct field experiments. N. H. M.

Analytical Chemistry.

Iodometric Estimation of Telluric acid. By F. A. Gooch and J. Howland (*Zeit. anorg. Chem.*, 1894, **7**, 132—136).—Telluric acid is reduced by hydriodic acid, and iodine is set free; but when the free iodine is titrated with sodium thiosulphate, from 20—26 per cent., more iodine is found than that required for the reduction to tellurous acid. Telluric acid may be accurately estimated as follows. The telluric acid is treated with potassium bromide and dilute sulphuric acid in a distillation apparatus, and a stream of carbonic anhydride passed through the boiling solution in order to remove the bromine. The latter is conducted into a solution of potassium iodide and the liquid titrated with sodium thiosulphate. The results agree very well with one another and with the acceptance of 127 as the atomic weight of tellurium.

The authors prepare their standard solution of tellurium as follows. Tellurium dioxide, obtained by dissolving pure tellurium in nitric acid and heating the product at a red heat, is dissolved in strong potassium hydroxide and precipitated with dilute sulphuric acid. The precipitate is dissolved in sulphuric acid (diluted one half), treated with excess of potassium permanganate, neutralised with oxalic acid, and the excess of oxalic acid carefully destroyed with dilute permanganate solution.

A series of twelve determinations of the equivalent weight of tellurium dioxide by Brauner's method (Trans., 1891, 258), gave the molecular weight of tellurium dioxide = 159, and the atomic weight of tellurium = 127 (O = 16). E. C. R.

Volumetric Estimation of Phosphorus in Steel. By W. A. Noyes and E. D. Frohman (*J. Amer. Chem. Soc.*, 1894, **16**, 553—559).—The method proposed by Dudley and Pease (Abstr., 1893, ii, 553) is rapid and easy of execution and gives concordant results. There is, however, an uncertainty of about 10 per cent. as regards the factor which should be used for converting the iron equivalent of the permanganate solution into the phosphorus equivalent. The author's experiments conclusively prove that if the reduction of the molybdate compound by means of zinc and sulphuric acid is properly executed the metal exists in a form corresponding with the oxide Mo_2O_3. The conditions are (i) that the passage of the solution through the reducing flask should be preceded by that of some dilute acid, so that most of the air in the reducing flask may be expelled before the solution enters it; (ii) that the diluted solution shall pass through the reducing flask slowly and be followed by the acid wash-water without allowing any air to enter at the top; and (iii) that the reduced solution shall be titrated at once and without further dilution. It should be of a pure green, not an olive-green colour.

It is now a thoroughly established fact that in the yellow ammonium phospho-molybdate there exist twelve molecules of molybdic anhydride to one atom of phosphorus. The quantity of the latter may therefore be very correctly calculated from the amount of permanganate required to reoxidise the Mo_2O_3 to $2MoO_3$. L. DE K.

Analysis of an Apatite in a Laminated Graphite from Ceylon. By P. JANNASCH and J. LOCKE (*Zeit. anorg. Chem.*, 1894, **7**, 154—157). —The analysis was conducted as follows:—About 0·5 gram of the mineral is dissolved in strong nitric acid and evaporated to dryness with mercuric oxide. The residue is moistened with nitric acid, dissolved in water, heated to boiling, and neutralised with ammonia, whereby the phosphoric acid is precipitated as mercuric and calcium phosphates. The precipitate is washed, heated over a bare flame, dissolved in dilute nitric acid, and precipitated with molybdenum solution. The filtrate is concentrated, the excess of molybdic acid filtered off and the remainder of the molybdenum precipitated as sulphide; the iron and aluminium are then estimated in the solution. The filtrate from the iron and aluminium contains manganese, magnesium and calcium; these are separated by a method previously described (*Zeit. anorg. Chem.*, **6**, 57). The filtrate from the mercuric and calcium phosphates contains a small quantity of calcium and the alkalis. It is evaporated to dryness, heated until the mercuric oxide is separated, and then dissolved in hydrochloric acid; the calcium is determined as oxalate, the potassium by platinic chloride, and the sodium weighed as sulphate.

The chlorine in the apatite is determined by dissolving a portion in nitric acid containing silver nitrate: the fluorine by heating with concentrated sulphuric acid in a platinum apparatus and collecting the hydrogen fluoride evolved in pure sodium hydroxide and precipitating as calcium fluoride. E. C. R.

Detection and Estimation of Small Quantities of Arsenic in Copper. By F. A. GOOCH and H. P. MOSELEY (*Zeit. anorg. Chem.*, 1894, **7**, 127—131).—The estimation is based on a method described by Sanger (Abstr., 1892, 382), whereby the mirror of arsenic obtained is compared with a series of standard mirrors. Not more than 1 gram of the copper is dissolved in dilute nitric acid, 2—3 c.c. of strong sulphuric acid is added and the solution evaporated until fumes of sulphuric acid are evolved. The concentrated residue is then distilled with strong, hydrochloric acid and potassium bromide, and the distillate collected in dilute hydrochloric acid. The distillate is again distilled with a fresh quantity of potassium bromide, and the final distillate is treated with a small quantity of stannous chloride dissolved in hydrochloric acid in order to convert any free bromine into hydrobromic acid; it is now ready for the Marsh's apparatus. The results obtained by the authors show that 0·05 milligram of arsenic may be determined by this process with fair accuracy; and they give the results of analyses of commercial copper containing from 0·01—0·0005 per cent. of arsenic. E. C. R.

Apparatus for the Estimation of Carbonic Anhydride. By A. C. CHRISTOMANOS (*Ber.*, 1894, **27**, 2748—2751).—The apparatus described by the author is a modification of Bunsen's well-known apparatus, sulphuric acid being substituted for calcium chloride as the drying agent, and a more stable form given to the whole.

A. H.

Estimation of Carbonic Anhydride in the Air. By F. Kratschmer and E. Wiener (*Monatsh.*, 1894, **15**, 429—432).—The method described in this paper depends on the fact that when a solution of sodium carbonate is titrated with sulphuric acid at the ordinary temperature, using phenolphthaleïn as indicator, decolorisation of the latter takes place as soon as one-half of the sodium carbonate has been decomposed with formation of sodium sulphate and sodium hydrogen carbonate. With a mixture of solutions of sodium hydroxide and carbonate, decolorisation takes place as soon as the whole of the former and half of the latter have been neutralised. If, therefore, equal volumes of a solution of sodium hydroxide be titrated with sulphuric acid, the one immediately, and the other after shaking with a known volume of air containing carbonic anhydride, the difference in the amount of acid required in the two cases is equivalent to one-half of the amount of sodium carbonate formed by the carbonic anhydride.

The authors employ a solution of sulphuric acid of such strength that 1 c.c. is equivalent to 1 milligram of carbonic anhydride, and the number of milligrams of carbonic anhydride in any volume of air taken is found by doubling the number of cubic centimetres representing the difference between the two titrations.

H. G. C.

Indirect Methods of Analysis. By H. Schiff (*Gazzetta*, 1894, **24**, ii, 30—36).—In connection with the work of Forte (Abstr., 1894, ii, 332), the author refers to his own papers (*Annalen*, **105**, 219; **107**, 69) on indirect methods of analysis. W. J. P.

Avoidance of Certain Causes of Error in Hydrotometric Analysis. By A. Bomboletti (*Gazzetta*, 1894, **24**, ii, 26—30).—On applying Clark's soap test to very hard waters, running the soap solution into the undiluted sample, and also into diluted portions, the results obtained are not concordant among themselves. If the water is rich in earthy matter, it should be diluted with distilled water until the hardness is about 22° (parts of calcium carbonate per 100,000 parts of water). If the water is soft, the results obtained by the soap test make it seem too hard. In this case, the standard solution of calcium chloride, whose hardness is known, is diluted until of about the same degree of hardness as that of the sample under examination; the hardness of this is then determined and is found to be greater than the extent of the dilution indicates. Taking the degree of dilution of the standard into consideration, the true hardness of the water to be examined can be calculated (compare Neugebauer, Abstr., 1891, 116). W. J. P.

General and Physical Chemistry.

Refractive Indices of Aqueous Solutions of Cadmium Salts. By R. DE MUYNCK (*Ann. Phys. Chem.*, 1894, [2], **53**, 559—563).—From a study of the transference of the ions in solutions of cadmium salts, Hittorf (1859) was led to the conclusion that these solutions contain double, or even triple, molecules of the salts in question. The author has, with the aid of the Pulfrich refractometer, determined the refractive indices of solutions of several cadmium salts, in order to ascertain whether the optical properties of these solutions indicate any peculiarities in the molecular condition of the dissolved salts. No abnormal results were, however, obtained, a careful comparison with zinc iodide and similar salts showing that with reference to the refractive indices, the behaviour of solutions of cadmium salts is normal. H. C.

Refractometric Observations. By J. F. EIJKMAN (*Rec. Trav. Chim.*, 1894, **13**, 13—33).—The author describes the apparatus and methods employed in his refractometric researches. (See Abstr., 1893, ii, 1.) H. C.

Spectrum of the Electric Discharge in Liquid Oxygen, Air, and Nitrogen.—By G. D. LIVEING, and J. DEWAR (*Phil. Mag.*, 1894, [5], **38**, 235—240).—Liquid oxygen, air, and nitrogen, like non-electrolysable compound liquids, offer great resistance to the passage of an electric discharge, so that the spark could only be made to pass through a thickness of 1 mm. of liquid. When the thickness was less than this, a succession of sparks could be maintained; but the resistance appeared to be very great, and the disruptive effect on the platinum electrodes was sufficient to discolour the liquid by the particles thrown off their surfaces. The discharge through the liquid in all cases gave a continuous spectrum and some bright lines traceable to the electrodes, whilst the rays supposed to have been emitted by the molecules of the liquid were less conspicuous. It seems not unlikely, therefore, that the continuous spectrum was due to the particles thrown off the electrodes.

With liquid oxygen boiling at atmospheric pressure, and both electrodes being immersed in the liquid at a distance of 1 mm. or less, a continuous spectrum is obtained, brightest in the yellowish-green, but extending to some distance both on the red and on the blue side. The absorption bands of oxygen were conspicuous on this bright background. With a Leyden jar in circuit, the brilliance of the spectrum is increased and some additional lines brought out. Many more bright lines were produced by keeping only the lower electrode immersed in the liquid, so that the spark passes partly through the liquid and partly through the gas immediately above it. Most of these correspond with known lines of oxygen. Exhaustion of the gas above the liquid, until the pressure was reduced to about 10 mm.

of mercury, did not make any marked difference in the appearance of the spectrum so long as both electrodes were immersed in the liquid. But when the lower electrode only was immersed and a Leyden jar put in circuit, a good many bright lines came out. One of these is a line of wave length about 557, and may be identical with the auroral line, but further experiments will be required before the identity can be regarded as proved.

The passage of the discharge through the liquid produced much ozone. Not only was the smell of ozone very strong, but the liquid took the indigo tint, deeper than the blue of ordinary oxygen, which is characteristic of ozone. On one occasion, after the sparks had been passed through the liquid for a short time, an explosion ensued which shattered the vessel. This may have been an explosion of ozone.

The effects of the discharge through liquid air were very similar to those produced with liquid oxygen, as long as the pressure was that of the atmosphere, and no jar was in circuit. When a jar was used a much larger number of lines, generally resembling the ordinary air lines, were seen but not measured. When the pressure was reduced, the usual banded spectrum of nitrogen was seen, and was strong relatively to the spectrum of oxygen. As the liquid evaporated, and thereby lost more nitrogen than oxygen, the two green bands due to oxygen appeared to become stronger actually, as well as relatively to the nitrogen bands. In this case, the discharge produced oxides of nitrogen, which were detected in the residual gas when the air had all evaporated.

With liquid nitrogen at atmospheric pressure, both electrodes immersed, a faint very diffuse line was observed at about λ501. This became more distinct when only one electrode was immersed, and probably represents the strong double line of nitrogen in that position. With the jar in circuit, the spectrum was a series of bright lines similar to those given by gaseous nitrogen at atmospheric pressure. Under reduced pressure, one or both electrodes being immersed, and no jar used, the band spectrum of nitrogen appeared. On putting on the jar, this was replaced mainly by the line spectrum.

The spark spectrum of distilled water at the ordinary temperature and pressure was examined for the sake of comparison. Only hydrogen lines were obtained and none that could be identified with those of oxygen. H. C.

Clark Cell when producing a Current. By S. SKINNER (*Phil. Mag.*, 1894, [5], **38**, 271—279).—The experiments detailed in this paper were made with the object of ascertaining how far the total E.M.F. round the circuit differs from that of the open cell, in the case of a Clark cell which is being used to produce a current, and how far this new value for the E.M.F. changes when the current is maintained. The experiments were made on three cells, all much larger than the ordinary Board of Trade pattern of Clark cell. It was assumed that the total E.M.F. round the circuit is equal to that of the cell at rest; and therefore that the E.M.F. overcoming polarisation can be obtained by subtracting from the E.M.F. of the cells at rest the observed current. In this way it was found that

1. The E.M.F. of polarisation varies directly with the current density in a particular cell.

2. The E.M.F. of polarisation slowly increases when the current is maintained.

From the magnitudes of the quantities found in the experiments, it follows that small currents of approximately known value can be obtained by the use of Clark cells of small internal resistance which may be neglected in comparison with the large external resistance.
H. C.

Magnesium Voltaic Cell. By H. N. WARREN (*Chem. News.*, 1894, **70**, 179).—Attention is drawn to a modified Daniell cell with magnesium immersed in a strong solution of ammonium chloride in the porous pot, and a strongly acid saturated solution of cupric chloride in the outer receptacle. D. A. L.

Potential Differences between Metals and Electrolytes. By V. ROTHMUND (*Zeit. physikal. Chem.*, 1894, **15**, 1—32).—A capillary tube containing mercury or a liquid amalgam dips into a small cup containing mercury, covered by the electrolyte, and the capillary and electrolyte can be brought to any required difference of potential by means of a set of resistance coils and a Leclanché cell. The capillary tube is connected with a manometer, and the mercury always brought to the same point by an increase or decrease of the manometric pressure. When the E.M.F. due to the cell is equal to that between the amalgam and electrolyte no charge is received, and the surface tension is a maximum; the method hence consists in varying the difference of potential due to the cell until the manometric pressure required to bring the amalgam to its constant point reaches a maximum. Measurements were made with mercury and amalgams of lead, bismuth, tin, copper, zinc, and thallium, the electrolytes being sulphuric acid saturated with a salt of the dissolved metal, and with a complex mercury salt, such as mercuric potassic iodide. The E.M.F. of various galvanic chains were calculated from the results and compared with those obtained by direct measurement. The agreement was in most cases very satisfactory, so that the potential difference between the two metals or two electrolytes has but a slight influence on the E.M.F. of the cell. Variations occurring in the cases of the amalgams of tin, cadmium and thallium are probably due to the action of the acid on the surface of the amalgam. Discordant results were also obtained in the experiments with the complex salts, where it is noticeable that the absolute value of the surface tension at the maximum was below the normal value, in which case the author does not consider the method to be applicable. L. M. J.

Determination of the Resistance of Electrolytes. By F. KOHLRAUSCH (*Zeit. physikal. Chem.*, 1894, **15**, 126—130).—A criticism of the method employed by Wildermann (Abstr., 1894, ii, 376). The author is of opinion that the telephone method with alternate currents can be employed for much higher resistances than those examined by

Wildermann, and is more convenient and simple than the method of the latter, which involves the use of strong batteries. In the cases of much higher resistances, 100,000 ohms and more, he does not consider Wildermann's method sufficiently accurate to render its application useful. L. M. J.

Electrolytic Dissociation. By S. Tanatar (*Zeit. physikal. Chem.*, 1894, **15**, 117—123).—The decrease of conductivity of salts by the addition of alcohol is ascribed not to a decrease in the dissociation but to the increase of the ion friction. Addition of alcohol, however, also caused a decrease in the inversion velocity of sugar by salts, although this is dependent on the dissociation only. The author, therefore, attempts to estimate, by means of the thermal effects, the dissociation changes caused by alcoholic dilution. In all cases the thermal effects due to the water alone are observed simultaneously, and allowed for in the results. The addition of a 2N solution of hydrochloric acid to an equal volume of alcohol produces a heat absorption of only 0·137 Cal., so that the 2N solution in water and the 1·03N solution in 44 per cent. alcohol appear to be approximately equally dissociated. The addition of 300 c.c. alcohol to 250 c.c. of a 2N solution produced a development of about 1·02 Cal., apparently indicating increased dissociation. Potassium chloride dissolved in alcohol gives rise to a greater heat absorption than in water, the quantity being determined, both indirectly and directly, with concordant results. This effect is not an exceptional one, the same result obtaining with alcoholic solutions of potassium nitrate, sodium chloride, cane-sugar, acetic acid, and methylic alcohol, whilst it is also noticeable that the freezing point depression with potassium chloride is greater in dilute alcoholic than in aqueous solution.

L. M. J.

Melting Point Determinations at a Red Heat. By V. Meyer, W. Riddle, and T. Lamb (*Ber.*, 1894, **27**, 3129—3143; compare Abstr., 1894, ii, 6 and 268).—In place of the method already described (*loc. cit.*), it is found advantageous to determine the melting point of a small quantity of the salt contained in a platinum tube which is secured to the air-thermometer employed. A thick piece of platinum attached to a fine wire is dipped into the molten salt, which is then allowed to solidify; the wire, passing over a pulley, suspends a weight, which, in falling, strikes a bell. When fusion occurs, the weight is released, indicating the moment at which to observe the temperature.

The following melting points have been determined. Sodium chloride, 815°; sodium bromide, 757°; sodium iodide, 661°; potassium chloride, 800°; potassium bromide, 722°; potassium iodide, 684°; sodium carbonate, 849°; potassium carbonate, 878°; sodium sulphate, 863°; potassium sulphate, 1078°; rubidium iodide, 641°; cæsium iodide, 621°; calcium chloride, 806°; strontium chloride, 832°; barium chloride, 921°. M. O. F.

Melting Points of Mixtures of Isomorphous Salts. By F. W. Küster (*Zeit. physikal. Chem.*, 1894, **15**, 86—88).—The author points out that in Le Chatelier's researches on the melting points of isomorphous mixtures, out of the seven pairs of salts employed only three pairs are truly isomorphous, namely, (1) the carbonate and sulphate of potassium, (2) the similar salts of sodium, (3) the sulphate and chromate of potassium. The method also is only approximate, whilst the number of points taken is insufficient for an accurate construction of curves; on this account the author is of the opinion that there is no experimental ground for supposing that the melting point curves of mixtures of salts depart more from straight lines than those of other compounds (see Abstr., 1894, ii, 179).

L. M. J.

Law of Corresponding Boiling Points. By U. DÜHRING (*Ann. Phys. Chem.*, 1894, [2], **52**, 556—588).—The law of corresponding boiling points was enunciated by the author in 1877, and can be formulated thus—

$$(t' - s')/(t - s) = q = \text{const.},$$

or

$$t' = s' + q(t - s),$$

where s and t are the boiling points of a substance at the pressures p_1 and p_2, and s' and t' are the equivalent boiling points of some other substance. This law is attributed by Young to Colot (*Phil. Mag.*, 1892, [5], **34**, 510), in a paper in which Young maintains that this formula is only an approximation, and does not represent the facts as closely as the formulæ proposed by Ramsay and Young. The author in this paper quotes a large number of experimental results which are in better accordance with his law than with that which Young defends.

H. C.

Dühring's Law of Corresponding Boiling Points. By G. W. A. KAHLBAUM and C. G. v. WIRKNER (*Ber.*, 1894, **27**, 1894—1902).—The authors apply Dühring's formula (preceding abstract) to Kahlbaum's experimental results (*Ber.*, **27**, 1386), and find only an approximate agreement between the calculated and observed values, the differences being far greater than the probable errors of experiment.

H. C.

Law of Corresponding Boiling Points. By U. DÜHRING (*Ber.*, 1894, **27**, 3028—3035).—A reply to Kahlbaum and Wirkner (see preceding abstract).

H. C.

Fluidity of Metals at Temperatures Below their Melting Points. By W. SPRING (*Zeit. physikal. Chem.*, 1894, **15**, 65—78).—Many metals, when heated to temperatures considerably below their melting points, exhibit properties characteristic of the liquid state. For examination in this respect, the metals were turned into cylinders with ends as perfectly plane as possible, and placed end to end in an iron holder, pressure being applied by a screw. They were heated in this condition in a hot air bath, filled, if necessary, with an indifferent gas. Cylinders of aluminium, bismuth, cadmium, copper, tin, gold, lead, zinc, antimony, and platinum were employed, and in the first experiment two cylinders of the same metal were used. The temperature was kept for from 4 to 8 hours at from 200° to 400°, and it was found that, except in the case of antimony and platinum, the cylinders had alloyed so perfectly that they could be turned with one end fixed in a lathe, whilst if broken in a vice the fracture did not take place along the original surface of separation. Pairs of different metals were next employed, usually copper or lead with some of the other metals, with the result that, at the junction, an alloy of considerable thickness was formed, 18 mm. in the case of zinc and copper, and 15 mm. in the case of cadmium and copper. In the case of lead and tin, a cavity in the end of one metal was filled with mica, so that contact only took place at the edge. An alloy was formed to the thickness of 15 mm., of which 9 mm. were in the tin and 6 mm. in the lead. By the use of cylinders of copper and zinc, in which, owing to a central cavity, contact only took place at the edges, it was found that the surface of the copper above the cavity was coloured by a yellow alloy resembling that formed when copper is subjected to the action of zinc vapour, and which was not due to diffusion from the edges (see also Abstracts, 1893, ii, 168). For the explanation of these results, which are most marked with soft and non-crystalline metals, the author points out the assumption suffices, that the molecules of solids, like those of fluids, do not all move with the same velocity.

L. M. J.

Pressure, Volume, and Temperature Relations of Rarefied Gases. By E. C. C. Baly and W. Ramsay (*Phil. Mag.*, 1894, [5], **38**, 301—327).—After a summary of previous work on the subject of the volume and thermal expansion of gases under reduced pressure, the authors give a description of their apparatus, which consisted essentially of two McLeod gauges placed side by side, and connected on the one hand with a mercury pump for exhausting them, and on the other with apparatus for the admission of measured quantities of the gas under examination. On testing the McLeod gauges, the authors found that whilst they gave good results with pure hydrogen at high vacua, they were absolutely untrustworthy with carbonic anhydride under the same conditions, owing to surface condensation on the glass.

By heating one of the gauges to a known temperature by means of a vapour jacket, and comparing its readings with those of the other gauge, the following values were obtained for the coefficient of expansion of hydrogen.

Pressure in mm.....	4·7	3·47	0·25	0·096	0·077
Coeff. of expansion..	1/273·5	1/273·7	1/276	1/297	1/300·5

The coefficient of expansion of oxygen varied as follows.

Pressure in mm.........	5·1	2·5	1·4	0·083	0·07
Coefficient of expansion..	1/261	1/251	1/233	1/244	1/240

For nitrogen the numbers obtained were

Pressure in mm.........	5·3	3	1·1	0·8	0·6
Coefficient of expansion..	1/304	1/302	1/304	1/331	1/343

It was found that at a pressure of about 0·7 mm. the behaviour of oxygen was very abnormal, no definite readings being obtainable, and the coefficient of expansion sinking as low as 1/1500. This confirms Bohr's observation of the abnormality of oxygen with respect to Boyle's Law at a pressure of 0·7 mm. J. W.

Adsorption. By G. C. SCHMIDT (*Zeit. physikal. Chem.*, 1894, **15**, 56—64).—As the adsorption of gases by porous substances, such as charcoal, has been shown to obey Henry's Law, experiments were made with dilute solutions. Animal charcoal placed in iodine solution was first examined, and the ratio C_2/C_1 obtained, where C_2 is the quantity of iodine adsorbed by the charcoal, and C_1 the concentration of the iodine solution. This ratio is not constant, but an approximate constancy obtains for the ratio C_2^4/C_1. Experiments were similarly made with charcoal and acetic acid, the concentration being calculated for undissociated acid, also with cellulose and picric acid, and with silk and eosin or malachite green, but in no case was Henry's law obeyed. The author then contests the view that the process of dyeing consists in the formation of a solid solution, as, were it so, the partition coefficient between the solution and material dyed should be constant; but this his experiments with silk showed was not the case. That in true solid solution the partition coefficient is constant, is indicated by experiments with silicic acid and various solutions, the results in the cases of the sulphates, chlorides, and nitrates of potassium and hydrogen showing excellent agreement. From this, it is concluded that dyeing is not a case of solution, but is due to a surface action, and is akin to adsorption. L. M. J.

Passage of Hydrogen through a Palladium Septum. By W. RAMSAY (*Phil. Mag.*, 1894, [5], **38**, 206—218).—As palladium at moderately high temperatures permits hydrogen to pass through it, but not other gases, it behaves as a semipermeable membrane for mixtures of hydrogen with other gases. The author has made experiments to determine whether the pressures of hydrogen within and without a vessel of palladium become identical when the vessel is previously filled with nitrogen or another gas, and the hydrogen is allowed to pass inward through the walls. The following table shows the results obtained with different gases, the numbers being the ratio of the pressure of hydrogen inside the vessel to that outside the vessel after equilibrium had been reached.

Ratio from hydrogen and nitrogen at 280°	0·905
Ratio at 335°.......................................	0·898
Ratio with 50 per cent. of hydrogen at 335°	0·936
Ratio with 25 per cent. of hydrogen at 335°...........	0·934
Ratio from hydrogen and carbonic anhydride at 280°...	0·962
Ratio from hydrogen and carbonic oxide at 280°	0·954
Ratio from hydrogen and cyanogen at 280°............	0·969

The numbers approximate to the "theoretical" ratio 1, but never reach it. The author discusses the mechanism of the passage of hydrogen through palladium, and is disposed to the opinion that the hydrogen during its passage is in the atomic state. J. W.

Molecular Surface Energy of Ethereal Salts. By W. RAMSAY and Miss E. ASTON (*Proc. Roy. Soc.*, 1894, **56**, 162—170; and *Zeit. physikal. Chem.*, 1894, **15**, 98—105).—The ethereal salts studied by Young with reference to their thermal properties were subjected by the authors to an investigation of their surface energy. The following table contains the values of the constants *k* and *d* in the equation $\gamma(Mv)^{\frac{3}{2}} = k(\tau - d)$.

	Critical temp.	*k*.	*d*.
Methylic formate	214·0°	2·042	5·9
,, acetate........	233·7	2·109	4·5
,, propionate	257·4	2·182	5·3
,, butyrate.......	281·25	2·220	3·75
,, isobutyrate	267·55	2·248	5·25
Ethylic formate	235·4	2·020	4·5
,, acetate	251·0	2·226	6·7
,, propionate......	272·9	2·240	4·9
Propylic formate	264·85	2·110	4·85
,, acetate	276·2	2·227	5·0

It is apparent that the value of the constant *k* increases with the molecular weight, but never differs greatly from the mean value 2·121 for non-associating liquids. J. W.

Molecular Surface Energy of Mixtures of Non-associating Liquids. By W. RAMSAY and Miss E. ASTON (*Proc. Roy. Soc.*, 1894, **56**, 182—191; and *Zeit. physikal. Chem.*, 1894, **15**, 89—97).—The authors have investigated the change of capillarity with temperature in the following mixtures:—Toluene and piperidine, benzene and carbon tetrachloride, chlorobenzene and ethylenic dibromide, and chloroform and carbon bisulphide. The method was that of Ramsay and Shields. All the above liquids show no associating tendency when pure, and it was found that whilst the capillary rise, and the surface tension might differ from the average value when they were mixed, the rate of change of the molecular surface energy with the temperature remained normal, so that the average molecular weight of the mixture could be calculated. In the case of the mixture of chloroform and carbon bisulphide, there appears to be slight association at low temperatures. J. W.

Complexity and Dissociation of Liquid Molecules. By W. RAMSAY (*Proc. Roy. Soc.*, 1894, **56**, 171—182; and *Zeit. physikal. Chem.*, 1894, **15**, 106—116).—The author summarises the facts which have been held by Guye and others to indicate molecular complexity in liquids such as water, the alcohols, and the organic acids. From determinations of the molecular surface energy of these liquids at various temperatures, it is possible to calculate the degree of this complexity by means of the formula

$$x = \left(\frac{2 \cdot 121\,(1 + \mu\tau)}{k}\right)^{\frac{3}{2}},$$

where x is the complexity factor, and μ a constant for each substance. The following table contains the values of x for different temperatures.

Temperatures	20°.	40°.	60°.	80°.	100°.
Methylic alcohol..	2·32	—	—	2·14	2·09
Ethylic alcohol ...	1·65	1·59	1·52	1·46	1·39
Water	1·64	1·58	1·52	1·46	1·40
Acetic acid	2·13	2·06	1·99	1·92	1·86

J. W.

Relation between the Surface Tension and Osmotic Pressure of Solutions. By B. Moore (*Phil. Mag.*, 1894, [5], **38**, 279—284).—An attempt to show that osmotic pressure may be produced by difference in surface tension acting along the exceedingly fine capillary openings of almost molecular dimensions, which place the solution in connection with its solvent in the pores of the semipermeable wall which separates them. H. C.

Cryoscopic Molecular Weight Determinations. By K. Auwers (*Zeit. physikal. Chem.*, 1894, **15**, 33—55).—Hydroxy-compounds, except phenols, when examined in solution in benzene, if the solutions are not too dilute, usually give abnormal values for the freezing point depression, whilst normal values are obtained with the ketones and aldehydes. The author, therefore, makes a large number of determinations of the lowering of the freezing point of this solvent by a number of oxy-compounds, and from the results in some cases, discusses the probable constitution of the compounds.

Over 80 compounds were examined; chiefly keto-acids, keto-aldehydes, and the acidic derivatives of primary and secondary organic bases. Normal values are obtained with the derivatives of acetoacetic acid, and diacetylacetone appears also to be an entirely ketonic compound.

Similar results are obtained with the oxymethylene ketones, whilst allylic alcohol gives very abnormal values, thus differing from those compounds in which the hydroxyl-group is united to the doubly-linked carbon atom. The acid derivatives of primary bases also give abnormal results, but the variations disappear in the secondary and tertiary compounds, this being explained by the supposition of the migration of the imidic hydrogen. The mercaptans differ from the alcohols, being cryoscopically normal, whilst dithienyl, $C_8H_6S_2$, gives a normal value, although thiophen itself gives an abnormally high result. L. M. J.

Freezing-Point Depressions in Dilute Alcoholic Solution. By S. Tanatar, J. Choina, and D. Kozireff (*Zeit. physikal. Chem.*, 1894, **15**, 124—125).—The freezing-point depressions in mixtures of water and methylic or ethylic alcohol are observed for acetic acid, ethylic or methylic alcohol, sodic chloride, potassic chloride, hydrogen chloride, potassium nitrate, and cane-sugar. The depressions produced by the non-dissociated compounds, acetic acid and the alcohols, differ but little from those in pure water, that due to cane-sugar is double the normal value, being equal to that due to the dissociated compounds. The salts, in all cases, give a greater depression than in pure water, the value increasing with the alcohol content.

L. M. J.

Influence of Low Temperatures on the Laws of Crystallisation. By R. Pictet (*Compt. rend.*, 1894, **119**, 554—557).—All substances cooled below 70° become diathermanous, this characteristic becoming the more marked the lower the temperature to which they are cooled. In this behaviour, there is an explanation for the fact that a temperature of $-68·5°$ may be observed in liquid chloroform from which crystals are separating at $-83°$, and when the temperature of the surroundings is $-120°$ to $-130°$. To obtain the true temperature of crystallisation below $-50°$, it is necessary to avoid supercooling, and to allow the crystallisation to take place very gradually.

H. C.

Principle of Maximum Work and Entropy. By Berthelot (*Compt. rend.*, 1894, **118**, 1378—1392).—The author restates his well-known principle of maximum work. All apparent exceptions to this principle are explained as caused by the development or absorption of heat during the action, which is not of a purely chemical origin or character. The principle would hold in strictest form for reactions between solid substances at the absolute zero, the temperature being maintained constant, and the products of the reaction being also solid. If Kopp's law for the specific heats of solid substances were absolutely correct, the heat of the reaction would be independent of the temperature for solid substances, and the principle of maximum work would hold for temperatures other than the absolute zero.

According to known thermodynamical laws, when any system passes from the state a to the state b at constant temperature, the heat K developed during the change is always greater than the product of the absolute temperature T by the loss of entropy $(S_a - S_b)$,

$$K > T(S_a - S_b).$$

If T or $S_a - S_b$ are so small as to be negligable quantities, $K > O$, a statement that is obviously in agreement with the principle of maximum work as already explained.

If the change in the value of $S_a - S_b$ with T is a perfectly regular one, the relationship between the values of K for various systems at the absolute zero will hold at other temperatures. From this it would follow that the heat developed during chemical change at any given temperature may be considered as made up of two different portions, the one consisting in the heat that would be developed during the occurrence of the same change at absolute zero, and the other in the increase which is due to the raising of the temperature, a quantity that is evidently intimately related to the gain in entropy of the system. By calculation, this view is shown to be consistent with the results obtained for the displacement of bromine and iodine from bromides and iodides in solid form by solid chlorine at the absolute zero and at 200° C., and also for the displacement of iodine by bromine under like conditions.

H. C.

The Assumption of a Special Nascent State. By L. ANDREWS (*Chem. News*, 1894, **70**, 152—153).—It is asserted that the assumption that nascent hydrogen has a special activity is not necessary for the explanation of the reduction of ferric to ferrous chloride by zinc, of copper sulphate by zinc, of sulphuric acid by copper, or of nitric acid by various metals, as all may be regarded as cases of direct oxidation. D. A. L.

Nascent State. By J. C. GREGORY (*Chem. News*, 1894, **70**, 188—189).—The author does not consider the statements made in the preceding abstract have been positively demonstrated, and points out that there are many other instances of nascent activity that cannot be explained in the manner suggested; for instance, the activity of oxygen freshly liberated from ozone or set free from water by chlorine.
D. A. L.

Extraction Apparatus. By L. ÉTAIX (*Bull. Soc. Chim.*, 1894, [3], **11**, 259—260).—The essential feature of this apparatus is a syphon tube, the short arm of which opens at the bottom of the extraction vessel, the long arm into the lower flask, the syphon being protected by an outer tube. By this means, the solvent used alternately half fills the extraction vessel, so as to cover the substance to be extracted, and is then automatically drawn off into the lower vessel. It may be used for cold or boiling extractions. L. T. T.

Inorganic Chemistry.

Action of Thionyl Chloride on Inorganic and Organic Acids and Aldoximes. By C. MOUREU (*Compt. rend.*, 1894, **119**, 337—340).—When pure sulphuric acid is mixed with excess of thionyl chloride, a mixture of sulphurous anhydride and hydrogen chloride, in molecular proportion, is evolved without appreciable development of heat, and the residue is a mixture of chlorosulphonic acid, $SO_2Cl{\cdot}OH$, and pyrosulphuric chloride, $S_2O_5Cl_2$.

With nitric acid, thionyl chloride acts violently, with development of heat and formation of nitroxyl chloride, sulphurous anhydride, and hydrogen chloride. Nitrogen oxides and sulphuric acid are also formed, in consequence of secondary actions between the hydrogen chloride, the excess of nitric acid, and the sulphurous anhydride.

Phosphoric, metaphosphoric, and boric acids are at once attacked by thionyl chloride, but with metaphosphoric acid the action is incomplete, whilst phosphoric and boric acids form chlorinated condensation products, which are not further attacked by the thionyl chloride.

Thionyl chloride, even at its boiling point, has no action on oxalic acid, but sodium, mercury, and silver oxalates yield a metallic chloride, sulphurous anhydride, and carbonic oxide and carbonic anhydride.

In order to moderate the action, the thionyl chloride must be dissolved in ether or benzene. No trace of oxalic chloride, $C_2O_2Cl_2$, was formed.

Anhydrous formic acid yields carbonic oxide, hydrogen chloride, and sulphurous anhydride, no liquid being left when the action is complete.

Aldoximes are violently attacked by thionyl chloride, but in presence of benzene the action proceeds regularly. The thionyl chloride acts as a dehydrating agent, and converts the aldoximes into the corresponding nitriles, $R{\cdot}CH{:}NOH + SOCl_2 = SO_2 + 2HCl + R{\cdot}CN$. With benzaldoxime the yield of nitrile is 70 per cent., with isovaleraldoxime 48 per cent., and with œnanthaldoxime 62 per cent.

C. H. B.

Secondary Products containing Nitrogen formed during Combustion in Air. By L. ILOSVAY DE NAGY ILOSVA (*Bull. Soc. Chim.*, 1894, [3], **11**, 272—280).—See this vol., ii, 61.

Schuller's Yellow Modification of Arsenic. By H. McLEOD (*Chem. News*, 1894, **70**, 139).—The author obtained the yellow modification of arsenic, first discovered by Schuller, by heating arsenic in carbonic anhydride or in a vacuum. It reverts spontaneously to ordinary arsenic, the change commencing at the warmer part of the deposit, and extending gradually but rapidly to the cooler portion.

D. A. L.

Hydrate of Carbonic Anhydride: Composition of Gaseous Hydrates. By P. VILLARD (*Compt. rend.*, 1894, **119**, 368—371).—The hydrate of carbonic anhydride discovered by Wroblewski (Abstr., 1882, 1026) is analogous in its mode of formation and decomposition to the hydrate of nitrous oxide (Abstr., 1894, ii, 278). Combination between the gas and water takes place under simple pressure, and neither hydrate decomposes below 0° under ordinary pressure, except in presence of liquid water. Both hydrates have the same crystalline form, and neither of them acts on polarised light.

Analyses of the hydrate of carbonic anhydride by the method used for the hydrate of nitrous oxide gave results varying between $CO_2,6{\cdot}2H_2O$ and $CO_2,5{\cdot}9H_2O$, and the author concludes that the exact composition is $CO_2,6H_2O$, and hence the compound is strictly analogous to the nitrous oxide hydrate. The heats of formation of the two compounds are the same, $+15{\cdot}0$ Cal., from gas and from liquid water. The heat of dissolution under pressure is, in both cases, practically identical with the heat of fusion of the combined water.

A crystalline hydrate of sulphurous anhydride formed at 0° gave results varying between $SO_2,6{\cdot}1H_2O$ and $SO_2,6{\cdot}0H_2O$, and a hydrate of methylic chloride gave results between $MeCl,6{\cdot}3H_2O$ and $MeCl,5{\cdot}9H_2O$. It would seem, therefore, that the two hydrates have, respectively, the formulæ $SO_2,6H_2O$ and $MeCl,6H_2O$. In both cases the crystals are without action on polarised light, and seem to have the same form as the hydrates of nitrous oxide and carbonic anhydride.

These results render it very probable that the hydrates of all gases, except the hydracids, have the same constitution and are represented by the general formula $M,6H_2O$. C. H. B.

Triammonium Orthophosphate. By P. SCHOTTLÄNDER (*Zeit. anorg. Chem.*, 1894, **7**, 343—344).—See this vol., ii, 64.

Colloïdal Silver. By E. A. SCHNEIDER (*Zeit. anorg. Chem.*, 1894, **7**, 339—340).—The organosol Ag (EtOH) (Abstr., 1892, 775), when treated with organic solvents, either remains in solution or coagulation takes place, and the production or absence of coagulation shows the existence or otherwise of an organosol with the organic solvent employed. No coagulation is observed with propylic, isobutylic, tertiary butylic, or cetylic alcohol, ethylene glycol, glycerol, or phenol. Coagulation takes place after a few hours with trimethylamide and pyridine. Coagulation takes place at once with isopropylic, normal and secondary butylic alcohols, trimethylcarbinol, heptylic, cetylic or allylic alcohol, erythrol, octane, amylene, formaldehyde, œnanthaldehyde, acetone, ether, acetic acid, benzene, benzylic alcohol, metacresol, triethylamine, dimethylamine, diethylamine, and quinoline.

The solutions in which coagulation did not take place were observed for some months. With phenol, coagulation commenced after 14 days and gradually increased; and after one month coagulation was observed in the case of propylic and tertiary butylic alcohols. After two months, coagulation had taken place in all the solutions.

The organosol Ag (EtOH) was coagulated by ether, the precipitate washed with absolute ether and dried over sulphuric acid in a vacuum. It has a greenish, metallic lustre, loses 4·5 per cent. in weight when heated, and when allowed to remain in a damp atmosphere increases in weight to the extent of 15·82 per cent. The dry colloïd is entirely soluble in water. E. C. R.

Basic Calcium Salts. By TASSILLY (*Compt. rend.*, 1894, **119**, 371—373).—When three parts of calcium oxide is added in successive small portions to a solution of 100 parts of calcium bromide in 75 parts of hot water, the filtered liquid, on cooling, deposits acicular crystals of the oxybromide $CaBr_2,3CaO + 16H_2O$, which may be washed with a 25 per cent. aqueous solution of calcium bromide.

The oxyiodide previously described (Abstr., 1894, ii, 92) may be more advantageously prepared in the same way as the oxybromide.

The oxybromide and oxyiodide are decomposed by water, alcohol, carbonic anhydride, and the stronger acids. The hydracids and very dilute nitric acid dissolve them readily, and sulphuric acid converts them into sulphates.

$CaBr_2,3CaO,16H_2O + 6HBr$ dil. .... develops +63·55 Cal.

and hence

$CaBr_2 + 3CaO + 16H_2O$ liquid ..... " +98·85 "
$CaBr_2 + 3CaO + 16H_2O$ solid ...... " +76·45 "

Further

$CaI_2,3CaO,16H_2O + 6HI$ dil......... " +63·4 " hence

$CaI_2 + 3CaO + 16H_2O$ liquid....... develops +102·3 Cal.
$CaI_2 + 3CaO + 16H_2O$ solid .... „ + 79·3 „

It is noteworthy that the heat of dissolution of the oxy-salt in the corresponding hydracid is practically identical in the three cases, but the heat of formation from the proximate constituents increases with the atomic weight of the halogen. C. H. B.

Action of Phosphorus Trichloride on Magnesium Nitride. By E. A. SCHNEIDER (*Zeit. anorg. Chem.*, 1894, **7**, 358).—When phosphorus trichloride is passed over magnesium nitride by the aid of a current of nitrogen, a violent action takes place at a red heat, and large quantities of phosphorus distil over. The residue consists of magnesium chloride and a bright, brown powder, which contains 19·26 per cent. of magnesium together with phosphorus and nitrogen. E. C. R.

Stability of Aqueous Solutions of Mercuric Chloride. By E. BURCKER (*Compt. rend.*, 1894, **119**, 340—342).—Aqueous solutions containing 1 part of mercuric chloride and 1·14 parts of hydrogen chloride per litre of ordinary water (containing calcium carbonate) undergo only trifling alteration when exposed to air and light, and no alteration at all when kept in well-closed vessels in the dark. 0·5 gram of tartaric acid per litre has the same effect (compare Abstr., 1894, ii, 93 and 381).

Indigo-carmine has no decomposing effect on solutions of mercuric chloride in distilled water acidified with tartaric acid, even when they are exposed to light. C. H. B.

The Molecular State of Mercurous Chloride Vapour. By V. MEYER (*Ber.*, 1894, **27**, 3143—3145; compare Harris and Meyer, Abstr., 1894, ii, 353).—The author adheres to the conclusion already drawn (*loc. cit.*), and referring to the experiments of Fileti (Abstr., 1894, ii, 449), points out that no amalgamation occurs when a cooled gold surface is immersed in the mixed vapours of mercury and mercuric chloride; the evidence of the stability of mercurous chloride adduced by Fileti is, therefore, no longer valid. M. O. F.

Double Salts of Higher Chlorides of Manganese and Copper. By G. NEUMANN (*Monatsh.*, 1894, **15**, 489—494).—The compound $(NH_4)_2MnCl_5$ is obtained when manganese dioxide is allowed to remain for a considerable time in contact with concentrated hydrochloric acid, kept cool by immersion in a freezing mixture of ice and salt, and saturated with hydrogen chloride and chlorine; the brown solution thus obtained, when filtered and treated with a cold solution of ammonium chloride, yields the compound in violet-brown crystals. It is readily decomposed, the violet-brown aqueous solution, even when kept cool, becoming turbid from separation of manganese dioxide. In a precisely similar manner, the double potassium manganese chloride, K_2MnCl_5, is obtained. The formation of these compounds confirms the results obtained by Pickering (Trans., 1878, 654), and disproves Fisher's statement that a tetrachloride of manganese is formed (Trans., 1878, 409).

On passing a mixture of hydrogen chloride and chlorine into a well-cooled solution of cupric chloride, glistening, red needles, which quickly change to green, are obtained. These have the formula CuH_3Cl_5, whereas on passing hydrogen chloride into a well-cooled solution of cupric chloride, Engel (Abstr., 1888, 558) obtained a salt to which he ascribed the formula $CuHCl_3$, and Sabatier (Abstr., 1888, 1036, 1037) stated that the product formed was CuH_2Cl_4. Cuprous chloride, free from cupric salt, gives with hydrogen chloride the compound $CuHCl_2$, which crystallises in pearly-grey needles. The two compounds MnK_2Cl_5 and CuH_3Cl_5 are of interest on account of their illustrating the heptad nature of manganese and the octad nature of copper respectively. G. T. M.

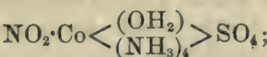
Constitution of Cobalt, Chromium, and Rhodium Bases. By S. M. Jörgensen (*Zeit. anorg. Chem.*, 1894, **7**, 289—330; Abstr., 1894, ii, 50).—Aquotetraminexanthocobalt salts are obtained from chloronitrotetraminecobalt chloride (Abstr., 1894, ii, 50), which is easily prepared by heating croceocobalt sulphate with concentrated hydrochloric acid.

Aquotetraminexanthocobalt chloride, $NO_2{\cdot}Co(OH_2,Cl)(NH_3)_4Cl$, is obtained by warming the above chloride with water and a few drops of acetic acid, and allowing the solution to crystallise over sulphuric acid. If treated with concentrated hydrochloric acid, it is reconverted into the anhydrous chloride, and after drying in the air gives up its water when allowed to remain over sulphuric acid.

Aquotetraminexanthocobalt hydrate, $NO_2{\cdot}Co(OH_2,OH)(NH_3)_4Cl$, is obtained when the anhydrous chloride is treated with dilute ammonia in the cold. It crystallises in deep red prisms, is converted into the anhydrous chloride by concentrated hydrochloric acid, and gives with silver nitrate a mixture of silver chloride and silver oxide. The formation of this basic salt shows that the two chlorine atoms in aquotetraminexanthocobalt chloride, although they behave in the same way towards silver nitrate, are combined in a totally different manner, namely, the one to the ammonia chain, the other to the radicle OH_2. When the anhydrous chloride is shaken with freshly-prepared silver oxide, it yields a yellowish-brown filtrate, which is strongly alkaline, liberates ammonia from ammonium salts, and no doubt contains aquotetraminexanthocobalt hydrate.

The preparation and properties of the following salts are described. The *bromide*, $NO_2{\cdot}Co(OH_2,Br)(NH_3)_4Br$; the *nitrate*,

$$NO_2{\cdot}Co(OH_2,NO_3)(NH_3)_4NO_3;$$

the *sulphate*,  $NO_2{\cdot}Co{<}\begin{matrix}(OH_2)\\(NH_3)_4\end{matrix}{>}SO_4$; the *platinosochloride*,

$$NO_2{\cdot}Co(OH_2,Cl)(NH_3)_4Cl,PtCl_4;$$

the *aurochloride*, $NO_2{\cdot}Co(OH_2,Cl)(NH_3)_4Cl,AuCl_3$; the *diaminecobaltinitrite*, $NO_2{\cdot}Co(OH_2)(NH_3)_4[(NO_2)_2(NH_3)_2Co(NO_2)_2]_2$; and the *oxalate*, $NO_2{\cdot}Co(OH_2)(NH_3)_4{:}C_2O_4$.

Preparation of dinitrotriaminecobalt salts.—Dinitrotriaminecobalt nitrite is obtained by the oxidation of an ammoniacal mixture of cobalt chloride, sodium nitrite, and ammonium chloride, employed in the proportions represented by the following equation,

$$CoCl_2 + 3NH_4NO_2 + 2NH_3 + \frac{1}{2}O = 2NH_4Cl + \frac{1}{2}H_2O + (NO_2)_2Co(NH_3)_3{\cdot}NO_2.$$

The reaction varies, however, very considerably, according to the proportions of ammonium salt and ammonia employed, and under these varying conditions ammonium cobalt nitrite, ammonium diaminecobalt nitrite, croceocobalt chloride, xanthocobalt chloride, or croceodiaminecobalt nitrite is obtained. The triamine nitrite is also obtained by heating the ammonium diamine nitrite with water and concentrated ammonia on the water bath, also by boiling an aqueous solution of ammonium diamine nitrite and the flavonitrate with a few drops of acetic acid.

Dinitrotriaminecobalt chloride, $(NO_2)_2Co(NH_3)_3Cl$, is obtained by heating the triamine nitrite with hydrochloric acid. It crystallises in red tablets, yields all its chlorine as silver chloride when treated with silver nitrate, is converted into the triamine nitrite by sodium nitrite, and into the dichrochloride when warmed with concentrated hydrochloric acid. When warmed with ammonium nitrate and ammonia, and then treated with dilute nitric acid, it yields flavocobalt nitrate, whence the author concludes that the constitution of this salt is represented by the formula $(NO_2)_2Co{\cdot}NH_3{\cdot}NH_3{\cdot}NH_3{\cdot}Cl$.

The *dinitrotriamine bromide*, $(NO_2)_2Co(NH_3)_3Br$, and *dinitrotriamine sulphate*, $[(NO_2)_2Co{\cdot}(NH_3)_3]_2SO_4,2H_2O$, are also described.

The last part of the paper deals with the views put forward by A. Werner (*Zeit. physikal. Chem.*, 1894, **14**, 506), and the structure of the ammonio-cobalt salts. E. C. R.

Molybdamide. By H. Fleck and E. F. Smith (*Zeit. anorg. Chem.*, 1894, **7**, 351—357).—When freshly-prepared molybdic chloride, MoO_2Cl_2, is treated with sodium ethoxide in ethereal solution, a precipitate of sodium chloride is obtained; the filtrate, on evaporation, yields a blue, amorphous compound, which is converted into ammonium molybdate when dissolved in alcohol and treated with ammonia.

Molybdamide, $OH{\cdot}MoO_2{\cdot}NH_2$, is obtained when molybdic chloride dissolved in chloroform is treated with dry gaseous ammonia or shaken with aqueous ammonia. A black precipitate is obtained which is probably the diamide; it is, however, very unstable, and when extracted with alcohol is converted into the monamide; the latter is a brownish-red, amorphous powder.

Molybdic chloride forms more stable compounds with ethylamine than with ammonia, a mono- or di-ethylamide being formed according to the amount of ethylamine employed.

The *monethylamide*, $OH{\cdot}MoO_2{\cdot}NHEt + \frac{1}{2}H_2O$, is a white powder, which gradually turns reddish-brown on exposure to air; it is soluble in water, and yields ethylamine when treated with alkalis.

The *diethylamide*, $MoO_2(NHEt)_2$, is a reddish-brown powder, which gives off ethylamine on exposure to air, and gradually becomes white;

it reacts violently with nitric acid, yields ethylamine when treated with alkalis, and gives a deep blue solution with concentrated sulphuric acid. E. C. R.

Thorium Metaoxide and its Hydrate. By J. Locke (*Zeit. anorg. Chem.*, 1894, **7**, 345—350).—Thorium metaoxide, which is obtained by heating the oxalate, is found to have the composition Th_3O_5. It is also obtained when the normal thorium oxide containing iron is heated in a current of steam, or when the pure normal oxide is heated in hydrogen. A quantitative determination of the water formed by the last method of reduction gave numbers agreeing with those required for the reduction of ThO_2 to Th_3O_5.

Thorium metahydroxide is prepared by evaporating the metaoxide to dryness with hydrochloric acid, dissolving the residue in hot water and precipitating with ammonia. It is a pure white precipitate, and has the composition $Th_3O_5,2H_2O$; when dried at 100° it loses $1H_2O$. The metahydroxide, Th_3O_5,H_2O, is also obtained when the metaoxide is treated with hydrochloric acid, but if prepared by this method it forms a brownish residue resembling varnish.

E. C. R.

Vanadium in Commercial Caustic Soda. By H. L. Robinson (*Chem. News*, 1894, **70**, 199).—A solution of caustic soda became deep purple in colour when saturated with washed hydrogen sulphide, but on exposure to light with access of air the colour slowly faded, the liquid becoming yellowish, and a brown precipitate being formed; this was found to be due to the presence of vanadium, but this element apparently is not present as a vanadate. D. A. L.

Mineralogical Chemistry.

Dimorphous Minerals. By C. Doelter (*Jahrb. f. Min.*, 1894, ii, Mem., 265—277).—The phenomenon of polymorphism, notwithstanding numerous theories, is not yet definitely elucidated. O. Lehmann, Mallard, and others have recently assumed that if two substances exhibit different crystalline forms they must also be chemically different. With diamond and graphite, P. Groth also classes andalusite and disthene among the chemically dimorphous substances. With a view to thoroughly investigate the matter, the author has submitted a number of dimorphous modifications, under conditions as nearly as possible similar, to the action of various agents, such as chlorine, hydrogen chloride, hydrogen fluoride, &c. The following minerals were treated. (1) Andalusite and cyanite, (2) orthoclase and microcline, (3) epidote and zoisite, (4) enstatite and anthophyllite, (5) diopside and actinolite, (6) iron pyrites and marcasite, (7) zinc-blende and wurtzite.

With marcasite and iron pyrites, the solubility in water and in sodium sulphide is identical, but the action of soda is quantitatively different. With zinc-blende and wurtzite, the differences are slight.

From the fact that on treatment with water and sodium sulphide new substances are formed which are identical with the modification employed in the experiment, the conclusion is arrived at that chemical difference of the dimorphous modifications of ZnS and of FeS_2 also exist in the solutions of the two, as the conditions of temperature were the same in the experiments. Marcasite is notably less decomposed by soda solution than pyrites is. Cyanite and andalusite exhibit but slight differences in behaviour when treated with decomposing agents. With enstatite and bronzite, chemical differences probably exist. In the case of actinolite and diopside, no safe conclusion can be drawn on account of the varying proportions of magnesium and calcium. B. H. B.

Natural Oxides of Manganese. By A. Gorgeu (*Jahrb. f. Min.*, 1894, ii, Ref., 404—406; from *Bull. Soc. fran. min.*, 1893, **16**, 96—104, 133—148).—The author has published a further instalment of the description of his investigation on manganese oxides (compare Abstr., 1890, 570; 1891, 270; 1894, ii, 19 and 99). Analyses are given of pyrolusite from various localities, of manganite from Ilfeld, of hausmannite from Ilmenau, and of braunite from S. Marcel and from Schwarzenburg. B. H. B.

Chromite in Lower Silesia. By H. Traube (*Jahrb. f. Min.*, 1894, ii, Ref., 411—414; from *Zeit. deutsch. geol. Ges.*, 1894, 50—67).—Chromite occurs in small quantities widely distributed throughout the serpentine of the Zobten Mountains. Recently a workable deposit has been found at the Schwarzenburg, near Tampadel. The chromite has a sp. gr. of 4·21, and contains

Cr_2O_3.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	Total.
41·23	24·58	2·28	16·99	0·58	14·77	100·43

It resembles the chromite of Grochau. The associated minerals are fully described. B. H. B.

Formation of Magnesite and Dolomite. By F. W. Pfaff (*Jahrb. f. Min.*, 1894, *Beilage*, **9**, 485—507).—The author describes the experiments which he has had in progress for the past three years to obtain dolomite and magnesite artificially. The experiments did not differ essentially from those of v. Marlet (1847), Hoppe-Seyler (1875), Scheerer (1866), and others. B. H. B.

Davyn. By H. Traube (*Jahrb. f. Min.*, 1894, *Beilage*, **9**, 475—479).—The author gives the results of an investigation of the figures produced on etching davyn. The material employed was obtained from Vesuvius, and hydrochloric, hydrofluoric, and nitric acids were used, the latter being found the most suitable. Analysis of carefully-selected material gave the following results.

SiO_2.	Al_2O_3.	CaO.	K_2O.	Na_2O.	Cl.	SO_3.	CO_2.
33·12	28·60	9·91	11·91	7·22	5·14	2·38	2·88

B. H. B.

Chemical Nature of Staurolite. By C. RAMMELSBERG (*Jahrb. f. Min.*, 1894, *Beilage*, **9**, 480—484).—In the staurolite of Lisbon, Penfield found dark carbon-bearing inclusions. In that of Mount Campione, the author found enclosed crystals of blue cyanite. From his analyses, Penfield deduced the formula $H_2R''_2R_5Si_4O_{26}$. The author now brings forward arguments to show why he is unwilling to accept Penfield's formula. B. H. B.

Rocks and Minerals from the Karakoram Himalayas. By T. G. BONNEY and Miss C. A. RAISIN (*Proc. Roy. Soc.*, 1894, **55**, 468—487).—The authors describe a series of specimens of rocks and minerals collected by W. M. Conway during his journey in the Karakoram Himalayas. The rocks of special interest described are some consisting almost wholly of hornblende, specimens of piedmontite schist, and of schist with conspicuous secondary mica. Among the minerals, is an interesting pseudo-jade, a fragment found on a moraine; microscopic examination and chemical analysis show that this specimen cannot be referred to nephrite. It appears to be composed of a lime-garnet, a potash-jadeite, a mineral of the scapolite group, and a little pyroxene. B. H. B.

Water and Sea-bottom Deposits from the Eastern Mediterranean. By K. NATTERER (*Monatsh.*, 1894, **15**, 530—595; compare Abstr., 1893, ii, 216, and 1894, ii, 102).—In this communication, the author gives furthur particulars of analyses of water and sea-bottom deposits obtained during the voyage of the ship "Pola," in the Eastern Mediterranean during 1893. G. T. M.

Physiological Chemistry.

Simple Form of Gas Pump. By L. HILL (*J. Physiol.*, 1894, **17**, 353—355).—This is a modification of the mercurial pump suitable for the examination of small quantities of blood. Its construction is figured. W. D. H.

Heat Value of Nutritive Substances. By F. STOHMANN (*Zeit. Biol.*, 1894, **31**, 364—391).—In addition to certain generalisations contrasting animal and plant life and their mode of nutrition, and the products they give rise to, the chief part of the present paper contains tables of the elementary composition and heat value of the most important animal and vegetable proteïds, albuminoids, derivatives of these such as urea, and the amido-acids, animal and vegetable fats and carbohydrates. Berthelot's apparatus was used.

W. D. H.

Heat Production in the Chick before and after Hatching. By M. S. PEMBREY, M. H. GORDON, and R. WARREN (*J. Physiol.*, 1894, **17**, 331—348).—Up to the 20th or 21st day of incubation, the chick responds to changes of external temperature like a cold-blooded animal; then there is an intermediate stage when no response is obtained, and when the chick is hatched it responds like a warm-blooded animal. The method used was a modification of Haldane's apparatus. W. D. H.

Blood Coagulation. By L. LILIENFELD (*Zeit. physiol. Chem.*, 1894, **20,** 89—165; compare Abstr., 1894, ii, 22).—In this paper, in addition to a historical account of the question, a full description of experiments and theories is given, part of which has appeared in several preliminary communications. The active agent in coagulation is regarded as a nucleo-albuminous substance, named *nucleo-histon;* it is considered to originate from leucocytes, especially from their nuclei, and from platelets. The nuclein in this substance hastens, whilst the histon hinders, coagulation; the separation into nuclein and histon can be effected by lime water or baryta water. Nuclein alone, and calcium chloride alone, do not cause coagulation in solutions of Hammarsten's fibrinogen; but if acetic acid is added to a solution of fibrinogen, a substance is precipitated which is coagulated by nuclein with calcium salts, or by calcium salts alone. This substance is termed thrombosin; and fibrin is regarded as a calcium compound of thrombosin. The constituent of fibrinogen which remains in solution when thrombosin is precipitated by acetic acid, is like peptone in some of its properties, particularly in its hindering influence on coagulation. Nuclein, or rather nucleic acid, acts just like acetic acid, precipitating free thrombosin from fibrinogen (not a nucleic acid compound of thrombosin). This holds both for intravascular and extra-vascular coagulation; nucleic acid first splits up the fibrinogen molecule, and then one of its components, thrombosin, unites with a calcium salt to form fibrin. The fibrin-ferment is described as a globulin which is a product and not the cause of coagulation. W. D. H.

Glucase. By F. RÖHMANN (*Ber.*, 1894, **27**, 3251—3253).—The author, in conjunction with Bial, has recognised the presence of an enzyme in blood-serum and lymph, which has the power of transforming starch into glucose (Abstr., 1893, i, 187). He now states that the enzyme affects glycogen in a similar manner. Bial has already shown (Abstr., 1893, ii, 333, 581) that blood-serum transforms dextrin and maltose into glucose. The author finds that by the action of saliva on starch paste, isomaltose, maltose, and dextrin are formed, together with a small amount of glucose; whilst by the action of pancreatic juice and intestinal juice (*succus entericus*) on starch paste, a larger quantity of glucose is formed but not so large as that resulting from the action of blood-serum. Following, however, the velocity of the liquefication of starch paste and of the increase in the cupric reducing power, it is found that pancreatic juice acts more powerfully than saliva, the latter, however, liquefies starch paste more rapidly than blood-serum. Furthermore, saliva and pancreatic juice bring about a quicker rise of the cupric reducing power of the transformation products to a maximum, but this is lower than the maximum attained by the action of blood-serum over a considerably longer period.

According to the author, the simplest explanation of these results is that saliva, pancreatic juice, intestinal juice, and blood-serum contain both diastase (maltase) and glucase, the former being present in largest amount in the pancreas, and in the smallest in the blood, and *vice versâ* as regards glucase. By allowing fresh yeast cells to remain over alcohol, whereby the glucase is destroyed, the aqueous extract no longer acts on maltose but only on saccharose. Invertase and diastase can thus be prepared free from glucase.

A. R. L.

Action of Calcium and other Salts on the Animal Organism. By H. Weiske (*Zeit. Biol.*, 1894, **31**, 421—448).—A number of rabbits were fed on oats, a diet which is acid and poor in calcium, and the observations showed that they lost weight; a comparison being made with other animals who received in addition calcium carbonate, calcium sulphate, strontium carbonate, or magnesium carbonate. At the end of the research the composition of their bodies, and especially of the skeleton, was examined. The salts administered correct the acidity and harmfulness of the oats; calcium carbonate having the best effect, both as regards the general condition of the animals and the amount of calcium in the skeleton. The bones show also that strontium and magnesium can replace part of the calcium. The urine and fæces also show evidence of the different salts administered.

W. D. H.

Calcareous Concretions in the Brain. By F. B. Mallory (*J. Pathol. and Bacteriol.*, 1894, **3**, 110—117).—These not uncommon deposits are due to the calcareous infiltration of colloid material (hyaline of v. Recklinghausen) which is deposited in the blood vessels. In the larger vessels, the middle coat is earliest and most affected.

W. D. H.

Salivary Glands of the Leech. By J. M. Croockewit (*Tijdschr. d. Ned. Dierk Vereen.*, 1894, 296—312).—It is the secretion of these glands which prevents the coagulation of the blood. Most of the present paper is anatomical. Some observations of a chemical nature seem to indicate that the substance to which the secretion owes the activity alluded to above is a nucleo-albumin.

W. D. H.

Calcium in the Liver Cells of the Ox. By F. Krüger and W. Lenz (*Zeit. Biol.*, 1894, **31**, 392—399).—The ox in different states of development furnished the material for the research. The calcium in the liver cells of the calf is about 70 per cent. greater than in the fully-grown animal. The fœtal period shows two maxima, namely, in the fifth and tenth months; at these times, there is 45 per cent. more calcium than in the adult; the minima also appear to be two, occurring in fœtuses of 20—30 and 60—70 cm. long respectively. The amount of calcium varies inversely with that of the iron during the fœtal period; they are described as antagonistic. Sex and pregnancy make no difference.

W. D. H.

Percentage of Sulphur and Phosphorus in the Hepatic and Splenic Cells at different Ages. By F. Krüger, F. Szymkiewicz, L. v. Lingen, and H. Walter (*Zeit. Biol.*, 1894, **31**, 400—412).—The amount of sulphur in the liver cells of oxen remains fairly constant throughout life, and in different individuals of the same age varies within certain narrow limits. Phosphorus is more variable; the fœtal cells are richest, and during fœtal life the percentage is fairly constant; it is less in the calf, less still in the grown ox. Sex makes no difference.

With regard to the spleen, again sulphur varies but little, being, however, rather less abundant in calves than in the fœtal and full-grown periods. Phosphorus is most abundant in fœtuses between 30 and 60 cm. long, sinks at birth, rises suddenly after birth, and is lowest of all in the grown animal. Sex has no influence.

During the fœtal period, the sulphur in the splenic cells is about 16 per cent. higher than in the liver cells; after birth, the two are about equal, and in grown cattle the splenic cells are about 9 per cent. richer in sulphur than the liver cells. Fœtuses of 30—60 cm. length have 39 per cent. more phosphorus in the splenic than in the liver cells. In fœtuses of 80—90 cm. length, the amount of phosphorus is about the same in the two varieties of cells; whilst in fœtuses of 90—100 cm. length, the liver cells contain 16 per cent. more phosphorus than the splenic cells. After birth, the splenic cells again contain more phosphorus by 25 per cent. than the liver cells; in grown cattle, there is an approximate equality, although the total amount of phosphorus is less than in calves and fœtuses.

In adult men, the liver cells contain 2·41 of sulphur, 1·28 of phosphorus, and 0·077 of iron per cent. In the liver of new-born children, the numbers are respectively 3·56, 1·54, and 0·314. The adult man and ox are in this connection very much alike. In fatty degeneration of the liver, the numbers were 2·18, 0·87, and 0·176, that is, sulphur and phosphorus fall, whilst iron rises.

W. D. H.

Caseïn of Human Milk. By A. Wroblewski (*Inaug. Diss., Bern*, 1894).—The mean of analyses of the caseïn of human milk gives C, 45·01; H, 7·31; N, 15·07; P, 0·8; S, 4·7; O, 27·11 per cent. It differs from the caseïn of cow's milk in solubility, and in the fact that on peptic digestion it yields no residue of nucleïn.

W. D. H.

Phosphorus in Digestion Products of Caseïn. By W. v. Moraczewski (*Zeit. physiol. Chem.*, 1894, **20**, 28—51).—A series of five experiments show that the amount of phosphorus in the nucleïn left after the digestion of caseïn by artificial gastric juice is variable, and that all the phosphorus of the caseïn is not in the form of nucleïn; from 6 to 60 per cent. of the phosphorus is present in this form. The caseïn of human milk contains phosphorus but no nucleïn (compare Wroblewski, preceding abstract). W. D. H.

Egg-shells of Echidna and other Vertebrates. By R. Neumeister (*Zeit. Biol.*, 1894, **31**, 413—420).—The egg-shells of *Echidna aculeata* (*E. hystrix*) consist of a keratin-like substance containing

5 per cent. of sulphur. It is, however, digested neither by gastric nor by pancreatic juice; some other keratins are similarly resistant. In invertebrates, the organic basis of egg-shells is chitin or some other skeletin. Keratin appears to be only present in the egg-shells and membranes of vertebrate animals. In the frog only has mucin been described. The eggs of some birds and reptiles are briefly referred to in this connection. Calcium carbonate is the principal inorganic constituent. W. D. H.

Acidity of Urine. By V. LIEBLEIN (*Zeit. physiol. Chem.*, 1894, **20**, 52—88).—This gives a long and critical account of the various methods, chemical and colorimetric, by means of which the acidity of urine, and the various factors of which it is made up, can be determined. The following general conclusion is drawn, that by the estimation of phosphoric acid in the form of diphosphate alone, can a trustworthy measure of the acidity of urine be obtained.

W. D. H.

Ethereal Hydrogen Sulphates in Urine. By J. EIGER (*Chem. Centr.*, 1894, i, 873; from *Pharm. Zeit. f. Russland*, **23**, 149—151).—The ethereal hydrogen sulphates in the urine are increased in most diseases of the liver; the liver, under normal circumstances, probably oxidises aromatic substances. In intestinal catarrh and in kidney diseases (especially chronic ones), these constituents of the urine are also increased. By disinfection of the alimentary canal and rapid removal of its contents, the ethereal hydrogen sulphates are diminished. α- and β-naphthol, hydrochloric acid, hydrogen phosphate, and sulphuric acid cause an increase; quinine nitrate and lactic acid, a decrease in these sulphates. Calomel produces the latter result when it causes purgation also. Potassium iodide, arsenic, ipecacuanha, digitalis, Convallaria, *Adonis vernalis*, opium, morphine, codeine, and bismuth salicylate have no effect.

W. D. H.

Hæmatoporphyrin in Normal Urine. By A. E. GARROD (*J. Physiol.*, 1894, **17**, 349—352).—Renewed research confirms the author's previous conclusion that hæmatoporphyrin is a scanty but normal constituent of urine. 20 c.c. of a 10 per cent. solution of sodium hydroxide are added to every 100 c.c. of urine; the precipitated phosphates are collected and washed with water. The precipitate is dissolved in rectified spirit and acidified with hydrochloric acid; the solution shows the bands of acid hæmatoporphyrin. Ammonia is then added to precipitate the phosphates, and acetic acid to redissolve them; chloroform then extracts hæmatoporphyrin completely, and shows the bands of the alkaline pigment.

W. D. H.

Pigmentation of Uric acid Crystals Deposited from Urine. By A. E. GARROD (*J. Pathol. and Bacteriol.*, 1894, **3**, 100—106).—Of the true urinary pigments which exist ready formed in urine, only the normal yellow pigment (urochrome) and uroerythrin appear to possess the property of colouring uric acid crystals deposited from their solutions. The yellow pigment being a constant constituent of urine always furnishes the ground tint of the crystals, and plays the more important part in determining their form, the whetstone or canoe shape being specially the one produced. In the majority of instances, uric acid crystals which are spontaneously and rapidly deposited from urine, contain uroerythrin also, to which they owe their red colour when seen in bulk. It is, however, never the sole colouring matter in these sediments, and varieties of tint are due to differences in admixture of it with urochrome. The minute quantity of iron present in the crystals is a constituent of neither pigment. Urobilin and hæmatoporphyrin take no part in the coloration of the crystals, but other pigments occasionally present in urine may share in the coloration, such as the brown products caused by the action of mineral acids, the oxidation products of phenol-derivatives, and the pigments of the bile. W. D. H.

Percentage of Iron in the Liver in Aukylostomiasis. By B. Rake (*J. Pathol. and Bacteriol.*, 1894, **3**, 107—109).—The percentage of iron in liver and spleen in five cases of disease, due to the presence of the worm *Aukylostoma duodenale*, is given. The interest of such an investigation arises from the fact that the symptoms produced are very like those of pernicious anæmia.

	1.	2.	3.	4.	5.	Average percentage.
Liver....	trace	0·26	0·2068	0·0123	0·0228	0·100
Spleen...	0·04	3·28	—	0·0592	0·071	0·862

The average percentage of iron in the liver is less than in other diseases, and much less than in pernicious anæmia; thus: aukylostomiasis, 0·1; other diseases, 0·12; pernicious anæmia, 0·7. The iron in the spleen is scarcely affected.

The intense anæmia associated with the disease is simply due to loss of blood from the intestine, and is not caused by any toxic substance causing blood destruction in the liver. W. D. H.

Piperazine as a Solvent of Uric acid Stones in Urine. By J. Fawcett (*Brit. Med. J.*, 1894, ii, 1426).—An aqueous solution of piperazine dissolves uric acid stones, but a solution of this substance in urine of the strength of 1 in 1000, which is above that usually found in the urine after taking the drug internally, has no effect whatever. W. D. H.

Physiological Action of certain Pyridine, Naphthalene, and Quinoline Derivatives. By R. Cohn (*Ber.*, 1894, **27**, 2904—2919; *Zeit. physiol. Chem.*, 1894, **20**, 210—218; compare Abstr., 1893, ii, 544).—In rabbits, quinaldine is entirely destroyed in the organism. In dogs, this is probably the case also, but the examination of the urine was more difficult, and the result somewhat uncertain. 1-Methylquinoline is in dogs entirely destroyed in the body. 3-Methylquinoline is changed into the corresponding quinoline-3-carboxylic acid in small measure (7 per cent.); the rest is destroyed. W. D. H.

Action of Drugs on the Heart of Daphnia. By J. W. PICKERING (*J. Physiol.*, 1894, **17**, 356—359).—The heart of Daphnia can be easily observed with the microscope in the intact animal. The heart of each animal has an individual rhythm which, if external circumstances are unvaried, remains constant. Atropine sulphate, in doses of 0·3 milligram, increases the cardiac frequency; but after a period of from 20 to 30 minutes the heart becomes irregular, and, finally, stops in diastole and its irritability is lost. Muscarine nitrate, in large doses, has practically no effect on the heart, although it causes violent intestinal action, and, finally, loss of general irritability. Veratrine, in doses of 2 milligrams, does not seriously impair the cardiac rhythm; its depressing action is removable by heat. Caffeïne causes, in small doses, increase of force and frequency; in large doses, tonic contraction and systolic stoppage; theobromine and xanthine have no effect. W. D. H.

Pharmacological Investigation of Manaca Roots. By J. BRANDL (*Zeit. Biol.*, 1894, **31**, 251—292).—The substances separated were manacin, $C_{22}H_{33}N_2O_{10}$, *manaceïn*, $C_{15}H_{25}N_2O_9$, a fluorescent substance identical with the æsculetin of Zwenger (*Annalen*, **90**, 63), valeric acid, and a material resembling humous substance. Lenardson (*Inaug. Diss., Dorpat*, 1894), who has worked at the same plant, gives the formula for manacin as $C_{15}H_{23}N_4O_5$. Manacin is convertible into manaceïn by the action of certain micro-organisms. In addition to botanical details, the bulk of the research refers to the physiological actions of manacin, the most marked of which is a stimulating action of the motor end plates and of secreting glands. Manacein causes very similar results. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Bactericidal Action of Light and Air. By R. F. D'ARCY and W. B. HARDY (*J. Physiol.*, 1894, **17**, 390—393).—Marshall Ward has shown that the bactericidal power of light is a peculiar property of light of short wave length, and is at its maximum at the violet end of the blue. This is only manifested in the presence of oxygen, and Würster (*Ber.*, 1886, **19**, 3201) has shown that "active oxygen" is produced when evaporation takes place in direct sunlight. The present experiments show that when the spectrum of a powerful arc light is allowed to fall on a moist surface in the presence of a delicate indicator, oxidation occurs, and the action commences at the blue end of the green, and continues through the blue, violet, and ultra-violet regions; in other words, the action is confined to a portion of the spectrum which corresponds with the region of activity in Ward's experiments. W. D. H.

Effect of Sunlight on Tetanus Cultures. By F. F. WESBROOK (*J. Pathol. and Bacteriol.*, 1894, **3**, 70—77).—The experiments confirm other observers in the conclusion that oxygen is a necessary factor in the destruction of bacteria by light. Without oxygen sunlight is powerless. Moreover, the oxygen in the contained air shows diminution during the exposure of cultures. W. D. H.

Thermophilic Bacteria. By A. MACFADYEN and F. R. BLAXALL (*J. Pathol. and Bacteriol.*, 1894, **3**, 87—99).—The paper gives an account of bacteria which flourish at a high temperature in manures, in the causation of spontaneous combustion, &c. It is difficult to believe that they are merely freaks which only develop when a bacteriologist appears on the scene with an incubator. Their wide distribution, their good growth at these high temperatures, and their active fermentative properties, all point to their fulfilling some useful function in the economy of nature. W. D. H.

Antiseptic Action of Phenyl-substituted Fatty Acids. By J. P. LAWS (*J. Physiol.*, 1894, **17**, 360—363).—Phenylbutyric acid restrains the growth of anthrax bacilli when present in the proportion of 1 to 2500; it kills the sporeless bacilli in 30 minutes in a solution of 1 to 1000, and in 10 minutes in a solution of 1 to 700.

The following table compares its action with related substances.

	Phenol.	Phenylacetic acid.	Phenylpropionic acid.	Phenylbutyric acid.
Restraining power..	1—700	—	1—1900	1—2500
Killing power......	1—200	1—450	1—600	1—1000
Length of exposure.	45 mins.	30 mins.	30 mins.	30 mins.

Antiseptic power thus increases with molecular weight; in the fatty acid series itself, the converse holds good (Duggan, *Amer. Chem. J.*, **7**, 62). W. D. H.

Assimilation of Free Nitrogen by Algæ. By A. KOCH and P. KOSSOWITSCH (*Bot. Zeit.*, 1893, **51**, 321—325).—The authors' experiments were as follows. Pure, ignited sand with nutritive salts (including calcium nitrate) was put into a number of Erlenmeyer flasks (60 grams of sand to each); in two experiments, sugar (0·05 gram) was added. The sand was seeded with algæ from a chalk heap, the flasks closed, and a slow current of purified air passed through There was an arrangement for absorbing any ammonia which might be evolved. Three flasks were kept dark, and three near a window for nearly 3½ months. In the flasks kept dark (and consequently free from algæ), there was no gain of nitrogen, whilst there was a distinct gain in the other flasks in which algæ developed—the greater the development of algæ, the greater the fixation.

N. H. J. M.

Fixation of Free Nitrogen by Algæ. By P. Kossowitsch (*Bot. Zeit.*, 1894, **52**, 97—116).—Frank (*Ber. d. bot. Ges.*, 1889, 34), and Schloesing and Laurent (Abstr., 1892, 1021; 1893, ii, 363) have shown that soil bearing a growth of green or bluish-green algæ gained nitrogen from the free nitrogen of the air, and the results were confirmed by Koch and Kossowitsch (preceding abstract); but the question whether the soil bacteria took any part in the fixation remained undecided.

In the present paper, results are described which were obtained by using (1) pure cultivations of algæ, and (2) impure cultivations with soil bacteria. As in the previous experiments (*loc. cit.*), thin layers of pure sand were employed with nutritive matter, which had to be varied according to the requirements of the algæ. Thus, whilst *Stichococcus* prefers the phosphate, KH_2PO_4, *Cystococcus* prefers K_2HPO_4. The addition of sugar was favourable to some forms, but had no effect on others.

In the first series of experiments, which comprised 18 flasks seeded with *Cystococcus*, there was no fixation of nitrogen, either with or without sugar. The algæ grew well so long as they were supplied with nitrate, but no longer.

In the other experiments, the sand was seeded with mixtures of algæ and bacteria, obtained partly from the chalk heap (*loc. cit.*) and partly from arable soil, the experiments being conducted similarly to those with *Cystococcus*. There were five pairs of experiments, the one of each pair having sugar, the other none. In 1 and 2, a pure cultivation of *Cystococcus* and a soil extract were employed for seeding; 3 and 4 were seeded from the silica employed in isolating *Cystococcus*; 5 and 6 from a sand culture of *Stichococcus*, which had proved to contain soil bacteria; 7 and 8 were seeded from a thick, gelatinous skin which had formed on sand seeded a year before from the algæ of the chalk heap; 9 and 10 were seeded from a mixture of algæ and bacteria from arable soil, which resembled the mixture used for 8 and 9. The following are the results obtained.

No. of expts.		Nitrogen (milligrams).		
		At commencement.	At conclusion.	
			Without sugar.	With sugar.
1, 2	*Cystococcus*, Phormidium, soil bacteria and mould	2·6	7·1	9·5
3, 4	*Cystococcus* and bacteria	2·6	3·1	8·1
5, 6	*Stichococcus* and bacteria..............	2·6	2·3	2·7
7, 8	*Nostoc*, large round algæ, Scenedesmus and soil bacteria	2·6	?	19·1
9, 10	*Nostoc* and soil bacteria	2·6	8·8	25·4

The results of both series of experiments show that neither *Cysto-*

coccus nor *Stichococcus* have the power of fixing nitrogen. Both in the author's and in Schloesing and Laurent's experiments, the greatest amount of fixation was observed when *Nostoc* was present. It is possible that *Nostoc* and some other algæ have the power of fixing nitrogen, but as yet there is no evidence of fixation by algæ in absence of bacteria, and the author is inclined to the opinion that it is the bacteria which assimilates free nitrogen. The evidence in favour of this view is the beneficial effect of sugar in Experiments 3 and 4. In the first series, with pure cultivations of *Cystococcus*, there was no fixation either with or without sugar. In Experiments 3 and 4 of the second series (see table), there was without sugar scarcely any fixation, with sugar considerable fixation, indicating that not the *Cystococcus*, but the bacteria, fixed nitrogen. With mixed algæ and bacteria, there was considerable fixation, both with and without sugar. The conclusion drawn is that here some algæ, especially the gelatinous ones, take the place of sugar in supplying nutriment to the bacteria. This theory would account for the fact that similar soils exposed to and screened from light gain and do not gain respectively. In the first case algæ develop, in the second case no algæ are found, and without the carbonaceous food for the bacteria, fixation cannot take place. It was observed that the gelatinous substance of the algæ was full of bacteria. There is, therefore, a symbiotic relation between soil bacteria and certain algæ similar to that of the *Leguminosæ* and the nodule bacteria.

Berthelot (Abstr., 1893, ii, 429) and Gautier and Drouin (*ibid.*, 1888, 746 and 871) showed that the fixation of nitrogen in soils depends on the presence of organic matter. N. H. J. M.

Assimilability of Potassium in Poor Sandy Soils by the Action of Nitrates. By P. Pichard (*Compt. rend.*, 1894, **119**, 471—473).—It was previously shown (Abstr., 1893, ii, 548) that newly-formed nitrates are the most readily assimilated. The results of experiments now described show that the potash of siliceous rocks is rendered available by nitrification, or by the application of nitrates. Tobacco was grown in the white sand of Bollène; in the first series the sand was manured with the nitrates of sodium, calcium, and magnesium, and with superphosphate; in the second, with organic nitrogen and the phosphates of sodium, calcium, and magnesium; whilst in the third series potassium was applied as nitrate, sulphate, and phosphate, nitrogen being present as nitrate, and in cake. The most striking results were obtained with the first series, in which no potash was applied. There was 5·6 grams of potassium present, insoluble in aqua regia; of this, 0·66, 3·21, and 0·48 gram was assimilated by the tobacco manured respectively with calcium, sodium, and magnesium nitrates. In the second series (nitrogen applied in organic form), there was active nitrification; of 5·6 grams of potash, insoluble in aqua regia, the plants took up from 1 to 3 grams, the greatest amount being assimilated under the influence of calcium carbonate. It is concluded that potassium is absorbed by plants in the form of nitrate. The sandy soils of Bretagne, with plenty of organic nitrogen, give immensely increased yields of roots when treated with chalk and lime, especially when gypsum is added.

Taking into account the assimilability of potassium in the form of silicate under the influence of nitrates, the total potash of soils should be determined, as well as the potash dissolved by acids.

N. H. J. M.

Effect of Chlorides on Vegetation and on the Amount of Starch in Potatoes. By J. SCHULTE (*Bied. Centr.*, 1894, **23**, 706—707; from *Magdeb. Zeit.*, 1894, No. 244).—Field experiments were made in which peas, rye, and barley were grown without manure, and with calcium, magnesium, and sodium chlorides, magnesium and calcium sulphate respectively (470 cwt. per acre). Potatoes were grown without and with the same minerals, farmyard manure being applied in each case as well. The results, showing yield of grain and of potatoes, percentage and yield of starch in potatoes per Morgen, are given in a table. The figures show that the employment of chlorine compounds in the potassium salts* have no injurious effect at all, and that the magnesium chloride plot gave in most cases the highest yields, and, in the case of potatoes, much the greatest yield of starch.

N. H. J. M.

Effect of the Degree of Ripeness and of Manures on the Physical and Chemical Properties of Barley Meal. By C. KRAUS and A. STELLWAAG (*Bied. Centr.*, 1894, **23**, 667—670; from *Zeits. landw. Ver. Bayern*, 1894, 164—171).—Lower Franconian barley was grown without manure, and with sodium nitrate (120 kilos. per hectare), and Chevalier barley without manure, and with guano (300 and 500 kilos.). The ears were examined at three or four periods of ripeness; the dry matter, flintiness, starch, proteids, and weight of grains per thousand being determined. The flintiness increased with the ripeness of the grain, and was not influenced in the case of Chevalier barley by the difference in manuring.

As regards chemical composition, this is improved by ripening, the quantity of starch increasing whilst the nitrogen diminished. The best composition is not obtained as a rule until the grain is yellow-ripe. Generally speaking, heavy manuring gives better yields if the crop is not laid; in this case, light grains rich in nitrogen are produced. With increased percentage of nitrogen, the grains are more flinty.

N. H. J. M.

Nutritive Value of Cocoa. By H. COHN (*Zeit. physiol. Chem.*, 1894, **20**, 1—27).—The constituents of cocoa were separated by methods which are described, and their amount estimated. The beans and powdered cocoas of commerce were used; the former contained 48—50 per cent. of fat, and 10·8 of proteid; the latter, 32—33 per cent. of fat, 13·8 of proteid, and 12 of starch. Experiments in relation to its nutritive value were carried out in the usual way; the fat was found to be well digested, but the proteid not, nearly 50 per cent. of the latter being unused.

W. D. H.

Secondary Products containing Nitrogen formed during Combustion in Air. By L. ILOSVAY DE NAGY ILOSVA (*Bull. Soc.*

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* According to the text: there is no reference to potassium salts in the table.

Chim., 1894, [3], **11**, 272—280).—The author has estimated the amount of ammonia and of nitrogen oxides formed during the combustion of some fuels. The following table gives the results, calculated in grams, of product per kilo. of fuel.

	Nitrogen as nitrogen oxides. Gram.	Nitrogen as ammonia. Gram.	Total combined nitrogen. Gram.
Charcoal dried at 120°	0·1190	0·6481	0·7671
Charcoal heated at 600° for 2 hours	0·1279	0·3679	0·4958
Charcoal heated at 900° for 2 hours	—	0·0229	0·0229
Coke heated at 600° for 2 hours	0·1756	0·1289	0·3045
Coal-gas	0·0771	0·0052	0·0823
Hydrogen	0·3286	0·0236	0·3522
Carbonic oxide	0·0147	—	0·0147

Volume for volume, hydrogen and coal-gas produced the same weight of ammonia, and almost the same weight of nitrogen oxides. Carbonic oxide, on the other hand, produces less than half as much nitrogen oxide, and, of course, no ammonia. The ammonia formed during the combustion of coke or charcoal is probably only a product of the decomposition of these substances. Coal yields a much larger proportion of ammonia, of which a large part is produced during the destructive distillation antecedent to the true combustion of the coal.

From these figures (basing his calculations on the amount of coal mined each year, which he takes as 390,000,000 tons), the author calculates the quantity of combined nitrogen (assimilable by plant life) formed annually by the combustion of fuel to be 290,000 tons. Lawes and Gilbert calculated the combined nitrogen taken up annually by the soil to be 1,000,000,000 tons, whilst Boussingault's figure makes it 164,000,000 tons. The author thinks that his own total is probably largely increased by the nitrogen oxides produced during storms, by the amount of ammonia produced from the burning of coal being larger than the figure 0·7671, which he used, and from other sources, but that the figure of 1,000,000,000 tons is largely in excess of that actually absorbed by the soil. L. T. T.

Analytical Chemistry.

Estimation of Chlorine in Urine. By E. Bödtker (*Zeit. physiol. Chem.*, 1894, **20**, 193—202).—Mohr's method gives too high results, as the urine contains substances which hinder the end reaction, probably by dissolving silver chromate. To incinerate the urine first is a tedious process, and results as good are obtained by the following method, the principle of which is to perform the reverse of what is usually done, namely, to estimate silver by means of sodium chloride. The urine is first made strongly acid with nitric acid, and excess of silver solution added; in the presence of nitric acid, and absence of bromides, iodides, and thiocyanates, silver chloride is alone precipitated. By careful neutralisation of the filtrate with a feeble alkali, such as magnesia, a liquid is obtained in which the excess of silver can be estimated by titration with sodium chloride. W. D. H.

Sodium Thiosulphate for Standardising Iodine Solutions. By C. MEINEKE (*Chem. Zeit.*, 1894, **18**, 33—34).—Sodium thiosulphate may be completely freed from adhering moisture by treating the powdered substance, first with 96 per cent. alcohol, and then removing the excess of the latter by washing with ether. The ether is finally completely expelled by a current of dry air.

The product is absolutely free from mechanically adhering water, and, if satisfactory in other respects, constitutes a valuable reagent for ascertaining the strength of iodine solutions. L. DE K.

Estimation of Sulphur in Pyrites. By F. JOHNSON (*Chem. News*, 1894, **70**, 212).—One gram of pyrites is treated in a flask with 25 c.c. of nitric acid; after a quarter of an hour, 1·5 grams of potassium chlorate is added, the whole warmed for a quarter of an hour, and then evaporated to dryness; 20 c.c. of hydrochloric acid is added and boiled off, and another 20 c.c. added and half boiled off, the residue is diluted with 50 c.c. of water, filtered, and washed. The solution is then made up to 200 c.c., heated with 1·5 grams of sodium hypophosphite, slight excess of barium chloride added, and after three hours the clear liquid is decanted on to a filter, whilst the precipitate is treated with 1 c.c. of hydrochloric acid and 100 c.c. of boiling water, being filtered after five minutes. D. A. L.

Indole as a Test for Nitrites. By O. BUJWID (*Chem. Zeit.*, 1894, **18**, 364).—Indole gives a very delicate and beautiful reaction with traces of nitrites in water analyses. It is best to use a diluted alcoholic solution containing about 0·1—0·2 gram of indole per litre. Ten c.c. of the sample of water is mixed with a few drops of hydrochloric acid, and heated to 70—80°. A few drops of the reagent is now added, when, if nitrite is present, a beautiful red coloration is obtained, which in a few minutes will get somewhat darker. The author thinks that the reaction may also be utilised quantitatively. L. DE K.

Estimation of Carbonates and Caustic Alkalis in Mixtures. By P. L. ASLANOGLOU (*Chem. News*, 1894, **70**, 166—167).—Titrating total alkalinity with N/10 sulphuric acid, with methyl-orange as indicator, and then the alkalinity due to hydroxide with phenophthaleïn as indicator, gives erroneous results. Therefore, in place of the second titration, the author suggests estimating the carbonic anhydride in a Schrötter's apparatus, using methyl-orange to indicate the end of the action; he has obtained good results. Hydrochloric acid, or nitric acid distilled from urea nitrate, and not sulphuric, should be used for expelling the carbonic anhydride. D. A. L.

Estimation of Carbonates and Caustic Alkalis in Mixtures. By C. A. SEYLER (*Chem. News*, 1894, **70**, 187—188).—Phenolphthaleïn, although not to be highly recommended as an indicator for the estimation of carbonates in presence of hydroxides, is capable of giving accurate results if precautions are taken to prevent any loss of carbonic anhydride (compare preceding abstract). D. A. L.

Triammonium Orthophosphate and the Detection of Magnesium. By P. SCHOTTLÄNDER (*Zeit. anorg. Chem.*, 1894, **7**, 343—344).—When examining a solution for magnesium with ammonium phosphate, a precipitate of triammonium orthophosphate is sometimes obtained having the appearance of magnesium ammonium phosphate, and may thus lead to errors; this precipitate is especially liable to occur in the presence of much ammonium chloride and strong ammonia.

Triammonium orthophosphate, $(NH_4)_3PO_4 + 3H_2O$, is obtained by adding ammonium chloride to an ammonium phosphate solution, warming the mixture at 60°, and then adding ammonia. It crystallises from the solution, on cooling, in long, four-sided prisms, and gradually evolves ammonia when exposed to the air. E. C. R.

Estimation of the Heavy Metals by Titration with Sodium Sulphide. By G. NEUMANN (*Monatsh.*, 1894, **15**, 495—504).—The neutral solution of the metal to be estimated is first precipitated with a known excess of standard alkali sulphide, and the solution containing the suspended sulphide or hydroxide is rendered clear, if necessary, by the addition of sodium chloride solution. An aliquot part of the solution is then filtered off, or removed by means of a pipette, and the excess of sulphide indirectly determined in it; this is best done by boiling with a known excess of N/10 sulphuric acid and afterwards determining the unused acid by titration with N/10 potassium hydroxide. This indirect process is necessary, because the alkali sulphide destroys the colour of litmus and of phenolphthaleïn. The estimation of the amounts of metal in the following salts by this method gave excellent results :—alum, chrome alum, silver sulphate, copper sulphate, cobalt sulphate, cadmium sulphate, lead nitrate, manganese sulphate, nickel sulphate, ferrous sulphate, ferrous ammonium sulphate, ferric chloride. G. T. M.

Colorimetric Estimation of Picric acid in its Compounds with Organic Bases. By L. KUTUSOW (*Zeit. physiol. Chem.*, 1894, **20**, 166—169).—Ptomaïnes are readily separated from mixtures by the addition of picric acid; the compound can be weighed, but the method here recommended is to estimate the picric acid colorimetrically, either by the spectrophotometer, or, more readily, by the use of Hoppe-Seyler's double pipette (Abstr., 1892, 1264). W. D. H.

General and Physical Chemistry.

Refractometric Researches. By J. F. Eijkman (*Rec. Trav. Chim.*, 1894, **12**, 157—197).—In continuation of his refractometric observations (Abstr., 1893, ii, 1), the author has measured the molecular refractions and dispersions of a large number of organic compounds. He finds generally that in any series of homologous compounds there is a regular change in both the refraction and dispersion with rising molecular weight if the higher members of the series are alone considered, but that this rule never holds for the initial members of the series. As a typical example the following series may be quoted.

	(A − 1)MV.	Difference for CH_2.
Water	5·83	—
Methylic alcohol	12·93	7·10
Ethylic alcohol	20·54	7·61
Heptylic alcohol	58·39	5 × 7·57
Cetylic alcohol	126·76	9 × 7·59

The mean values obtained for the refraction of the CH_2 group from a large number of observations with different compounds, and using Gladstone's formula, are for the lines H_α, H_β, and for a ray of infinite wave-length A (calculated by means of Cauchy's formula)

$$\beta = 7·889$$
$$\alpha = 7·754$$
$$A = 7·590,$$

and for the dispersion $\beta - \alpha = 0·1353$.

The variations in the numbers actually obtained by observation from these mean values all lie within the limits allowable for error of experiment. H. C.

Optical Rotation of Ions. By P. Walden (*Zeit. physikal. Chem.*, 1894, **15**, 196—208).—The author determined the optical rotation of solutions of α-bromocamphosulphonic acid and some of its salts, at various dilutions and constant temperature (20·5°), employing for the purpose the apparatus of Schmidt and Hänsch. In the case of the free acid, an increase in dilution from $v = 2·08$ to $v = 120$ was accompanied by a decrease in the molecular rotation of from 287° to 270°, so that the undissociated molecule possesses a somewhat greater rotatory power than the dissociated molecule. In the experiments with salts of lithium, sodium, potassium, beryllium, magnesium, zinc, and barium, dilution has in most cases a similar effect, whilst at equal dilution (also approximately equal dissociation) the molecular rotations were approximately equal as seen in the table.

v.	H.	Li.	Na.	K.	Tl.	Be.	Mg.	Zn.	Ba.
30	+ 273°	275°	272°	273°	273°	274°	268°	272°	272°
120	+ 270	271	270	269	271	271	270	270	269

The rotation is hence dependent on the number of active ions, and at complete dissociation, in equimolecular solutions, the rotations of different salts containing the same active acid ion are equal.

In aqueous acetone solution (93 per cent. acetone), a much higher number (343°) was obtained at $v = 30$. The morphine and quinidine salts gave molecular rotations of $-100°$ and $+1008°$ respectively. The algebraic sum of the molecular rotations of the constituents being $-100°$ and $+996°$; the molecular rotation of an electrolyte of two active ions appears to be equal to the algebraic sum of their molecular rotations. L. M. J.

Development of the Latent Photographic Image by Alkali Peroxides. By G. A. Le Roy (*Compt. rend.*, **119**, 557).—Aqueous solutions of alkali peroxides, or a solution of hydrogen peroxide made strongly alkaline, can develop the latent image formed when emulsions of silver bromide or silver chloride in gelatin are exposed to light, the intensity of reduction being sensibly proportional to the quantity of light acting on the emulsion. The developing power of the alkali peroxides is, however, much below that of the substances usually employed as developers by photographers. The image, which consists of a mixture of metallic silver and silver oxides, is considerably reduced in intensity when placed in solutions of alkali thiosulphates or thiocyanates. C. H. B.

Light emitted during Crystallisation. By E. Bandrowski (*Zeit. physikal. Chem.*, **15**, 323—326).—The author considers the light emitted during crystallisation to be in all probability electrical, and due to the union of electrified ions; for this reason, it should be most marked in the sudden crystallisation of strongly dissociated compounds, and the following experiments, suitable also for lecture purposes, are described. A glass cylinder is half filled with a warm saturated, sodium chloride solution, and into it is poured an equal quantity of hydrochloric acid sp. gr. 1·12, and the solutions mixed by a glass rod, when a bluish-green light fills the whole cylinder. Or the two liquids having been carefully poured in, the cylinder is strongly shaken, when a flash of light occurs. Alcohol may also be used in place of the acid, and similar effects may be obtained by the use of potassium chloride or bromide instead of the sodium salts. The former compound with alcohol gave a most marked effect, the light being stronger and greener than that obtained with sodium chloride. L. M. J.

Some Voltaic Combinations with a Fused Electrolyte and a Gaseous Depolariser. By J. W. Swan (*Proc. Roy. Soc.*, 1894, **56**, 56—64).—The author describes a number of different cells of the Upward type, with a fused electrolyte and a gaseous depolariser. The electrolyte used was either the molten chlorides of sodium and potassium mixed, or chloride of lead. The cathode was always molten lead, and the anode carbon, chlorine being used as the depolariser. As a general conclusion, it was found that it is necessary that the surface of the carbon pole on which the cathion is deposited be alternately exposed to the action of the gas and the electrolyte. The research proves that it is possible to form pyro-batteries of the Upward type, although it is extremely difficult to realise the conditions required for effective action. H. C.

Polarisation. I. Solid Cathodes. By J. Roszkowski (*Zeit. physikal. Chem.*, 1894, **15**, 267—304).—For the polarising E.M.F., the author employed a Gülch thermopile of 50 elements, capable of yielding a pressure up to 3·5 volts; a Leclanché cell, and four standard Clarke cells being employed for its determination. The cathode examined was immersed in a N/10 solution of sulphuric acid, and the polarisation determined by the measurement of the E.M.F. obtained from this cathode connected with a calomel element, that is, practically, the chain, cathode, N/10 sulphuric acid, potassium chloride solution, mercury. Experiments on the effect of the duration of the current were made with cathodes of polished and platinised platinum, polished silver and mercury, and the polarisation reached its maximum constant value in from two to three minutes (polished platinum 15 minutes). The effect of the current strength on the polarisation was obtained by the addition of external resistances. With a platinised platinum cathode of 2 square cm. area and an E.M.F. of 3·3 volts, the polarisation decreased to a minimum of —180 volts when 700 ohms had been added, further addition having no effect. A similar decrease was obtained by the addition of internal resistance, that is, substitution of Leclanché cells for the thermopile. The influence of the size of the cathode was investigated by the use of mercury electrodes of respectively 1 and 2 square cm., and although for low E.M.F.s the smaller cathode gave markedly greater polarisation, at 3·3 volts the values were almost identical. The nature of the surface was then altered and platinum electrodes (1) polished, (2) platinised, (3) platinised and heated to redness, (4) covered with scratches, were employed. Very different values for the polarisation were obtained, the highest values being obtained with (4) and lowest with (2). The platinised cathode also gave the curve of polarisation, polarising E.M.F., approximately a straight line of inclination $\tan^{-1} \frac{1}{3}$.

In no case does a maximum value occur, and the differences the author considers to be due to different occluding powers of the surfaces. Similar experiments were performed with silver cathodes with entirely similar results, the differences between the differently prepared silver cathodes being, however, not as great as with the platinum electrodes. L. M. J.

Polarisation. II. Liquid Cathodes. By J. Roszkowski (*Zeit. physikal. Chem.*, 1894, **15**, 305—322; see preceding abstract).—Liquid cathodes consisting of mercury and amalgams of lead, zinc (1 per cent.) and copper (0·053 per cent.), were employed, and curves embodying the relations of polarisation to polarising force are given. In the cases of the zinc and lead amalgams, the curves are at first parallel to the axis of abscissæ, after which, like the other curves, they become approximately straight lines of inclination $\tan^{-1} 0·62$, and no indication of a maximum is apparent. A cathode of Wood's alloy was examined in both the solid and the liquid state, the effect of increase of temperature being first determined by experiments on mercury. With an E.M.F. of above 3 volts the effect of temperature became constant, namely, an *increase* of polarisation of about 0·0003 volt per degree. In the experiments with Wood's alloy, no change in the polarisation was observed at the point of fusion or solidification. The curves obtained for both solid and liquid also were almost identical, and closely resembled those previously obtained, being at first parallel to the axis of abscissæ. Hence in this case the nature of the surface has but little effect on the polarisation, which, if the E.M.F. is above a certain value, is approximately a linear function of the polarising force. L. M. J.

Influence of Electrolytes on the Conductivity of Acetic acid. By A. J. WAKEMAN (*Zeit. physikal. Chem.*, 1894, **15**, 159—182).—The conductivity was determined in the case of mixtures of acetic acid with varying quantities of cyanacetic, propionic, succinic, glycollic, and hydrochloric acids, and from the results the value of k was obtained. The conductivity was then calculated on the assumption that two solutions in which the concentration of the ions are equal do not alter on mixing, and hence that the effect of the addition of the solution of the second acid to the acetic acid solution may be regarded as (1) the abstraction of water from, or addition to, the latter until the two solutions become isohydric; (2) admixture of these isohydric solutions. The calculated values of the conductivity and of k obtained thus are compared with the observed values, and in most cases the agreement is very satisfactory. In the case of acetic and glycollic acids, concordance is only good when the former acid is in considerable excess. In all cases, as would be expected, the effect of strong acids is very much more marked than that of weak, the addition of $\frac{1}{200}$ cyanacetic or $\frac{1}{1000}$ of hydrochloric acid being very noticeable. The conductivity of hydrogen chloride dissolved in acetic acid was also determined, but, owing to the great resistance, only with approximate accuracy. Curves expressing the results are also given. L. M. J.

Thermoelectric Properties of Salt Solutions. By G. F. EMERY (*Proc. Roy. Soc.*, 1894, **55**, 356—373).—If a circuit is formed of two substances, one a metallic wire and the other a solution, and the junctions between the metal and the liquid are at different temperatures, an E.M.F. is developed in the circuit, which varies in magnitude nearly in proportion to the difference of temperature between the junctions, and, in comparison with the ordinary thermo-electromotive forces in metallic circuits, is very considerable. The author has made experiments to find out how the E.M.F. varies with variations both in the strength and in the nature of the solution. The results show that both have considerable influence on the magnitude of the E.M.F.

The E.M.F. per 1°, in terms of 10^{-4} volt as unity, θ, varies considerably with the concentration of the solution, and curves are plotted whose ordinates are equal to θ, and abscissæ are the corresponding concentrations in gram molecules per litre of volume. For zero concentration, the curves all appear to start from somewhere about $\theta = 8·6$ at an angle to the axes, and then, as concentration increases, the curves bend round more or less sharply until they are nearly parallel to the axes of concentration. For some salts, θ increases with increasing concentration, whilst for others it decreases, so that for thermoelectrical purposes we may divide salts into positive and negative, according as the value of θ for the solution is greater or less than its apparent value for pure water. The final value for θ in a solution appears to be due to the superposing of a salt effect on that due to the water itself.

A few experiments were made on the thermoelectric force generated in a purely liquid circuit, that is, in a circuit composed of two kinds of liquid, the junctions being at different temperatures. Experiments are also described, which lead to the conclusion that the thermoelectric forces at the junctions of metals and solutions are part of a system of reversible thermodynamic phenomena.

H. C.

Method for Determining the Thermal Conductivity of Metals, with Applications to Copper, Silver, Gold, and Platinum. By J. H. Gray (*Proc. Roy. Soc.*, 1894, **56**, 199—203).—One end of a given length of wire is kept at a constant known temperature. The rise of temperature of the other end of the wire is noted every minute, and, if proper precautions are taken to prevent loss by radiation from the sides, the data are obtained for calculating the thermal conductivity.

Several qualities of copper were tested, as well as pure gold, silver, and platinum. The values for the mean thermal conductivity in C.G.S. units, between the temperatures 10° and 97°, are given below.

	Conductivity.	Diameter.
Copper, Specimen 1	0·9594	2·00 mm.
,, ,, 2	0·88838	2·11 ,,
,, ,, 3	0·8612	3·09 ,,
,, ,, 4 (very impure)	0·3497	2·04 ,,
,, ,, 5 ,, ,,	0·3198	2·04 ,,
Silver (pure)	0·9628	2·02 ,,
Gold ,,	0·7464	2·00 ,,
Platinum (pure)	0·1861	2·00 ,,

Experiments to find out if there is any relation between the electrical and thermal conductivities confirmed what has been found by previous investigators, that if one metal is a better conductor for heat it is also a better conductor for electricity. The results did not, however, prove that the ratios were always the same, although in some cases they agreed very closely. H. C.

Specific Heats of Gases at Constant Volume. Parts II and III. Carbonic Anhydride. By J. Joly (*Proc. Roy. Soc.*, 1894, **55**, 390—391; 392—393).—The specific heat of carbonic anhydride at constant volume is given in terms of its variation with density ρ, for the mean specific heat between 12° and 100°, as

$$C_v = 0·1650 + 0·2125\rho + 0·3400\rho^2.$$

The following empirical equation expresses the line $\rho = 0·124$, calculated into a line of variation of specific heat with temperature.

$$C_v = a + 2b(100 - t) + 3c(100 - t)^2,$$

where t is the initial temperature of the experiment, and

$$a = 0{\cdot}19020000$$
$$b = 0{\cdot}00006750$$
$$c = 0{\cdot}00000182$$

H. C.

Law of Corresponding Boiling Points. By G. W. A. KAHLBAUM and C. G. v. WIRKNER (*Ber.*, 1894, **27**, 3366—3374).—A reply to Dühring's criticism (this vol., ii, 37).

Atomic and Molecular Solution Volumes. By J. TRAUBE (*Ber.*, 1894, **27**, 3173—3178).—If m is the molecular weight of a substance dissolved in water, aq the amount of water which holds unit molecular weight of the substance in solution, d the density of the solution, and δ the density of the water, the constant,

$$v_m = \frac{m + aq}{d} - \frac{aq}{\delta},$$

is called by the author the molecular solution volume, and the corresponding constant for the atom v_a the atomic solution volume. The densities of solutions of a number of compounds of some 50 elements have been determined, and a number of relationships between atomic and molecular solution volumes have been discovered. A summary of the chief results is given in this paper.

The elements hydrogen, lithium, sodium, silver, and univalent copper, gold, and silver have equal atomic solution volumes. In the series sodium, potassium, rubidium, and cæsium, the atomic solution volumes increase by about 10 units with every rise in atomic weight. The atomic solution volume of rubidium is equal to that of ammonium. The thallium compounds have somewhat greater molecular solution volumes than the corresponding potassium compounds.

The elements calcium, strontium, and lead have equal atomic solution volumes, as have also the elements zinc and magnesium, barium and cadmium, bivalent iron and manganese, bivalent copper and nickel. Cobalt has a greater solution volume than nickel, and beryllium has the highest solution volume of any of the bivalent elements.

Equal solution volumes were also noticed in the following cases. Platinum, palladium, and iridium; aluminium and tervalent iron; molybdenum and tungsten in molybdates and tungstates; chlorine and bromine in chlorates and bromates; chlorine and manganese in perchlorates and permanganates; nitrogen and vanadium in nitrates and vanadates; carbon and silicon in carbonates and silicates.

The green chromium compounds have a smaller molecular solution volume than the violet. Iodates have a smaller solution volume than chlorates and bromates, but iodides have a greater volume than bromides, and bromides a greater volume than chlorides. The atomic solution volume of fluorine is smaller than that of chlorine. An increase in atomic solution volume with rising atomic weight is observed also in the series: oxygen, sulphur, selenium, tellurium; nitrogen, phosphorus, arsenic, antimony; silicon, titanium, zirconium.

The molecular solution volume is in every case an additive function. Water of crystallisation does not appear to be present in any of the dissolved salts. An atom may change its solution volume with change of valency. This property the author proposes to indicate by the term "polysterism." It follows from this property that there is a direct relationship between valency and atomic volume. H. C.

The Critical State. By K. WESENDONCK (*Zeit. physikal. Chem.*, 1894, **15**, 262—266).—The author describes some of the appearances observable in carbonic anhydride at the critical state, and points out that at 31·7° nebulosity is observable and inhomogeneity exists so that the true critical point must be higher than this; further researches are therefore desirable. L. M. J.

Freezing Points of Concentrated Solutions. By R. ABEGG (*Zeit. physikal. Chem.*, 1894, **15**, 209—260).—The lowering of the freezing point was first determined in aqueous solution at concentrations up to 5 gram molecules per litre; the compounds examined being chiefly the lower alcohols, acids, and ethereal salts. The osmotic work was calculated according to both Arrhenius' and Raoult's formulæ, and the results shown graphically against concentration as abscissæ. The curves are usually convex to the axis of abscissæ, and in those calculated according to Arrhenius' formula the inclination increases with the molecular weight, the Raoult curves being less divergent. The hydroxyl group usually tends to make the curve steeper, the reverse obtaining for the carboxyl group. A downward bending can be explained by the formation of aggregates, and this occurs with those compounds where Ramsay's and Shield's experiments indicated association. A number of ethereal salts were also examined in acetic acid and benzene solutions, and the results recorded graphically, whilst by interpolation the molecular osmotic work (π/n) was obtained at a number of concentrations. Although the curves are not straight lines, a first approximation can be obtained by use of the formula $\pi/n = A + Bn$. In the case of mixtures, the osmotic pressure is greater than the sum of the osmotic pressures of the components separately, and this follows theoretically from the author's results, thus: $\pi_1 = An_1 + Bn_1^2$, $\pi_2 = An_2 + B_2n_2^2$; $\pi = A(n_1 + n_2) + \frac{B_1n_1 + B_2n_2}{n_1 + n_2}(n_1 + n_2)^2$, that is, $\pi = \pi_1 + \pi_2 + (B_1 + B_2)(n_1n_2)$.

The osmotic pressures for mixtures of cane sugar and methylic alcohol, glycerol and ethylic alcohol, acetic acid and ethylic alcohol and glycerol and cane sugar in aqueous solutions were calculated, the values for A and B being obtained from the previous experiments. The agreement with the observed values was very satisfactory, and best for the calculations according to Raoult's method.

L. M. J.

Solubility of Double Compounds. By R. BEHREND (*Zeit. physikal. Chem.*, 1894, **15**, 183—195; see also Abstr., 1892, 1047, 1385).—The solubility relations of a mixture of picric acid and anthracene, which unite to form a double compound, were determined.

The compounds were purified as completely as possible, finely powdered, and added to 120 c.c. of 99·5 per cent. alcohol, the vessel being kept in circular motion at a temperature of 25° for eight days, after which quantities of the solution were withdrawn, and the constituents estimated. Eleven experiments are recorded; in the first, the solution was saturated with anthracene solely; in the last, with picric acid only; in the sixth, the anthracene picrate was first obtained in excess. The difference between the anthracene in the first and sixth experiments gave the quantity present in the latter as picrate, a similar calculation being possible for the picric acid from the sixth and twelfth experiments. The quantities of picrate so calculated were respectively 0·137 gram and 0·105 gram, and the mean value 0·121 gram was employed. The composition of the solution calculated thus is given in the following table.

Anthracene (total), v ...	0·176	0·190	0·206	0·215	0·228	0·236	0·202	0·180	0·162	0·151	0·149	—
Picric acid (total)	—	1·017	2·071	2·673	3·233	3·469	3·994	5·087	5·843	6·727	7·511	7·452
Anthracene (free), u_1 ...	—	0·176	0·176	0·176	0·176	0·183	0·149	0·127	0·109	0·098	0·696	—
Picric acid (free), u_2....	—	0·999	2·032	2·623	3·166	3·401	3·926	5·019	5·775	6·659	7·443	—
Picrate, u	—	0·032	0·069	0·089	0·119	0·121	0·121	0·121	0·121	0·121	0·121	—

The values hence obtained for u_1u_2/u, vary only from 4·7 to 5·7, or within the experimental limits. L. M. J.

Graphical Representation of Heterogeneous Systems. By H. W. B. Roozeboom (*Zeit. physikal. Chem.*, 1894, **15**, 145—158).—The author gives graphical representations of the equilibrium of systems consisting of from 1 to 4 substances. In the latter case, the edges of a regular tetrahedron are taken as axes, the coordinates of any point being measured parallel to sides of the figure. The influence of temperature and pressure must be expressed by a series of such tetrahedra. In the selection of the components, the following must be observed, (1) they should be the least possible; (2) they must be capable of entering into the system in varying proportions; (3) they must be in actual equilibrium under the conditions of the experiment. Substitution systems, as for instance $KCl + I = KI + Cl$, may be considered by deriving the equilibrium from that of the system of the three simple components. Similarly a double decomposition is obtainable from the tetrahedron of the four simple components, whilst a decomposition with apparently five components is also reducible to that of four. L. M. J.

Principles of a New System of the Elements. By J. Traube (*Ber.*, 1894, **27**, 3179—3181).—The author has shown (this vol., ii, 70) that certain simple relationships exist between the atomic volumes of similar elements. In place of regarding the properties of the elements as functions of their atomic masses, he proposes an arrangement in which the atomic volumes are the determining factors. Similar elements then appear in groups having equal atomic volumes, or in which there are equal differences between the atomic volumes of allied elements. H. C.

Lecture Experiments: Ethyl Ether. By F. BRANDSTÄTTER (*Chem. Centr.*, 1894, i, 1145—1146; from *Zeit. physikal.-Chem. Unterr.*, **7**, 183—185).—The heaviness of ether vapour is easily shown by taking a small bottle half full of ether and closing it with a cork carrying two glass tubes; the one tube bent at right angles, and passing just through the cork, the other tube bent into an **S**-form, and having one end passing through the cork to just above the surface of the ether, the other and outside end being 6—8 cm. below the surface of the ether. The ether vapour will pass out of the lower end of this bent tube, and may be burnt. If two bottles, fitted in a similar way, are joined by a piece of rubber tubing, the size of the ether flame may be regulated by raising or lowering one of the bottles.

The lowering of temperature produced by the evaporation of ether is shown as follows. A strong test-tube is fitted with a cork carrying a thermometer and two glass tubes, the one reaching nearly to the bottom of the test-tube, the other just passing through the cork. The test-tube is charged with about 5 c.c. of water and 7 c.c. of ether, and a current of air passed through it. In a few minutes a temperature of $-7°$ to $-8°$ is obtained, and the liquid solidifies.

E. C. R.

Inorganic Chemistry.

Artificial Ice. By A. C. CHRISTOMANOS (*Ber.*, 1894, **27**, 3431—3437).—Ice produced from the water supply of Athens was found to be separable into transparent and opaque portions. A detailed analysis showed very plainly that of these two varieties the former only was fit for consumption, being almost pure; the impurities of the original water were divided in various proportions between the opaque ice and the small amount of water that did not freeze.

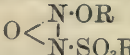
M. O. F.

Concentration and Distillation of Hydrogen Peroxide. By R. WOLFFENSTEIN (*Ber.*, 1894, **27**, 3307—3312).—Hydrogen peroxide is relatively stable when heated, provided that the solution is free from alkaline compounds, from derivatives of the heavy metals, and from solids of every kind, even those that are chemically indifferent. Commercial hydrogen peroxide, 3 per cent., can be concentrated on the water bath in an ordinary dish at 75° until it contains 47·7 per cent. The yield is 61·8 per cent., the loss is due to volatilisation, and not to decomposition, for, by the use of a beaker instead of a dish, the yield is 56 per cent. of solution, containing 64·7 per cent. of hydrogen peroxide. These solutions may be concentrated by distillation under reduced pressure, either directly or, preferably, after extraction with ether, to remove alumina. After repeated fractionation, almost pure (99·1 per cent.) hydrogen peroxide was obtained. It boils at 84—85° (68 mm.), is a colourless, syrupy liquid, does not readily moisten the containing vessel, is volatile in air, and irritates the skin, producing white marks which remain during several hours. It is strongly acid, and, when neutralised with alkali and distilled, the distillate readily reddens litmus. The preparation of large quantities of the pure peroxide is best accomplished by concentrating the commercial solution on the water bath until it contains about 20 per cent.; it is then evaporated under reduced pressure (68 mm.) until it contains 50—55 per cent., extracted with ether, and finally fractionated in a vacuum. The percentage of peroxide in the various solutions was determined by titration with potassium permanganate solution. The author is unable to confirm Schilow's statement, that a solution of peroxide containing 50 per cent. can be prepared by treating the commercial product (3 per cent.) with soda and extracting with ether.

The hydrates $H_2O_2 + H_2O$ and $H_2O_2 + 2H_2O$ have also been prepared; they are liquid at $-20°$, but solidify in a mixture of solid carbonic anhydride and ether. J. B. T.

Bye-products formed from the interaction of Ozone and Ammonia. By L. Ilosvay de Nagy Ilosva (*Ber.*, 1894, **27**, 3500—3503).—Carius, who has previously investigated this subject, found that ammonium nitrite and hydrogen peroxide were first produced, these then reacted further forming ammonium nitrate and water. The author gives a detailed account of his experiments, which are partly original and partly a repetition of Carius'. Ozone is readily absorbed by aqueous ammonia (2—20 per cent.) with formation of nitrite and nitrate. The action is more energetic as the concentration of the ammonia increases; whichever substance was in excess nitrate and nitrite were formed. Dry ozone and dry ammonia do not react at ordinary temperatures. Hydrogen peroxide could not be detected under any circumstances; the reagents employed for its recognition were titanium dioxide in concentrated sulphuric acid solution, and chromic anhydride and ether. J. B. T.

Formation of Hydrazine from Inorganic Compounds. By P. Duden (*Ber.*, 1894, **27**, 3498—3499).—Hydrazine is formed by the reduction of recently-prepared potassium dinitrososulphonate, $K_2SO_3N_2O_2$, with sodium amalgam at 0°, and is separated by treatment with benzaldehyde. Zinc dust and ammonium hydroxide or soda may also be used as the reducing agent; other substances which act in alkaline solution cause the formation of hydroxylamine, ammonia, and potassium hyponitrite in varying quantity, and the yield of hydrazine is consequently much diminished. J. B. T.

Salts of Dinitrososulphonic acid. By A. HANTZSCH (*Ber.*, 1894, **27**, 3264—3273).—The author considers that the salts of this acid probably have the symmetrical formula  $O<\begin{matrix}N\cdot OR\\ |\\ N\cdot SO_3R\end{matrix}$ rather than the asymmetrical one $NO\cdot N(OR)\cdot SO_3R$, proposed by Raschig. Two isomeric potassium salts have been described. One of these gives a precipitate with barium chloride which is insoluble in water, but which dissolves in hydrochloric acid to form a solution which remains clear for a short time, but then deposits barium sulphate (Pelouze), whilst the other was only once obtained by Raschig, and gives no precipitate with barium chloride, although, on the addition of hydrochloric acid, an immediate precipitate of barium sulphate is formed. The author has succeeded in obtaining this second salt, but has been unable to prepare that described by Pelouze. Concentrated solutions of this salt give with barium chloride a precipitate of the *barium potassium salt*, which is soluble in a large amount of water. The *silver potassium* salt is a white mass, which decomposes at 85° with evolution of red fumes. A. H.

Action of Hydrogen Phosphide on Potassammonium and Sodammonium. By. A. JOANNIS (*Compt. rend.*, **119**, 557—559).—When hydrogen phosphide is passed into a solution of potassammonium in liquefied ammonia, the gas is absorbed and hydrogen is evolved, a liquid being formed which does not mix with the ammonia, although not quite insoluble in it. When the action is complete, and the excess of ammonia is allowed to volatilise, potassium hydrogen phosphide or potassium phosphine, PH_2K, is obtained in slender, white needles. When heated, it is converted into potassium phosphide, PK_3, with evolution of hydrogen phosphide, and water also decomposes it with evolution of hydrogen phosphide.

Sodammonium behaves similarly, the quantity of hydrogen liberated corresponding with the formation of the compound PH_2Na. The liquid solidifies when slowly cooled. If, however, the tube is kept at 0° and the ammonia is allowed to escape, a considerable quantity is retained by the phosphide, and the liquid does not solidify. No definite compound of the phosphide and ammonia seems to be formed, and a further quantity of the latter is evolved when the liquid is allowed to acquire the ordinary temperature. If it is heated at 65°, still more ammonia is liberated, and the residue solidifies, and has the composition PH_2Na. It decomposes in the same manner as the potassium compound.

When nitrous oxide is allowed to act on these derivatives of phosphine, a volume of nitrogen is liberated equal to the volume of nitrous oxide employed, and the action is therefore quite different from that between nitrous oxide and the amides. C. H. B.

Crystallised Products formed in the Deacon Process. By A. ARZRUNI and E. SCHÜTZ (*Zeit. Kryst. Min.*, 1894, **23**, 529—535).—The authors give the results of the investigation of a series of crystallised products formed during the Deacon process of making chlorine, and presented to the collection of the Aix-la-Chapelle

Technical School by the director of the Rhenania Chemical Works at Stolberg. The following three compounds are described crystallographically and chemically.

1. $Cu(Fe_2)_2As_4O_{17}$, triclinic.
2. $Fe_2(AsO_3)_2$, monoclinic.
3. $Fe_2(AsO_3)_2 + 10H_2O$, rhombic.

B. H. B.

Mineralogical Chemistry.

Fresh Discoveries of Gypsum Crystals. By G. Staats (*Ber.*, 1894, **27**, 3181—3182).—Fully-developed crystals were found near Crone on the Brahe (? in Posen), in a clay associated with lignite; the clay contained lime, magnesia, alumina, and iron. Swallow-tail twins were seldom found, but intersection twins were common.

C. F. B.

Lindesite and Pyrrhoarsenite. By L. J. Igelström (*Zeit. Kryst. Min.*, 1894, **23**, 590—593).—1. *Lindesite* is the name given to a new mineral found in the parish of Linde, Örebro, Sweden. The mineral is of a brownish-red colour, and has a hardness of about 6. Analysis gave the following results.

SiO_2.	Fe_2O_3.	Al_2O_3.	MnO.	CaO.	MgO.	Na_2O.	H_2O.	Total.
48·37	21·92	2·47	10·97	5·76	3·49	6·12	0·90	100·000

The formula is $3RO,SiO_2,R_2O_3,SiO_2$. The mineral consequently approaches acmite and rhodonite in composition.

2. *Pyrrhoarsenite.*—This mineral was discovered by the author in 1886, and analysed subsequently by A. G. Högbom. The author has now analysed it himself with the following results.

As_2O_5.	MnO.	FeO.	CaO.	MgO.	Total.
51·88	28·38	trace	15·55	3·33	99·14

B. H. B.

Physiological Chemistry.

Influence of Intra-venous Injection of Dextrose on the Blood-gases. By V. Harley (*Proc. Roy. Soc.*, 1894, **56**, 148—154).—The experiments were made on dogs. Samples (30 c.c. in each) were collected before, an hour after, and 3—5 hours after the injection. There is a diminution in both carbonic anhydride and in oxygen after the injection. The lessening of carbonic anhydride supports the view that lactic acid derived from the sugar displaces the carbonic

anhydride in its combinations as sodium salt. The lessening of oxygen is very marked, and the explanation is not at present forthcoming.
W. D. H.

Contents of the Healthy Stomach. By A. L. GILLESPIE (*Rep. of Lab. R. C. P., Edin.*, 1894, **5**, 43—50; from *Edin. Med. J.*, 1893).—The following conclusions are drawn from the examination of the contents of the healthy stomach. (1) Free hydrochloric acid is secreted immediately the food enters; but this combines with proteïd, so that salivary action is not impeded during this first stage. The free acid does not appear in the stomach contents till from half-an-hour to two or three hours after the meal is taken; the time varies according to the composition of the meal. Hydrochloric acid combined with proteïd is less antiseptic than the free acid. The inorganic salts, especially the chlorides, and the total proteïds per cent. in solution fall during the progress of digestion. Albumin (probably mucin, *sic*) increases, albumoses remain stationary, and peptone diminishes.

Physiological text-books are stated to be in error concerning the amount of acid; the following numbers are derived from the present observations.

Total acidity from	0·108 to 0·36	per cent.
Combined acidity from ..	0·072 ,, 0·324	,,
Free acidity from	0·018 ,, 0·09	,,

The causes of variation are the time after the ingestion of a meal and the character of the food taken. The free hydrochloric acid is seldom over 0·09 per cent. after a proteïd meal, but it may rise to 0·162 or 0·27 after a meal chiefly carbohydrate in nature.
W. D. H.

Analysis of Gastric Contents. By A. L. GILLESPIE (*Rep. of Lab. R. C. P., Edin.*, 1894, **5**, 56—70; from *Internat. Med. Mag.*, October, 1893).—A description of certain methods for examining the gastric contents, with some modifications in the direction of simplifying them.
W. D. H.

Action of Acids and Alkalis on the Gastric Secretion. By A. L. GILLESPIE (*Rep. of Lab. R. C. P., Edin.*, 1894, **5**, 213—244).—An examination of the gastric contents after the administration of acids and alkalis in various forms of dyspepsia supports the well-known therapeutic doctrine that, if given before food, acids diminish and alkalis increase the acidity of the gastric juice.
W. D. H.

Gastric Digestion of Proteïds. By A. L. GILLESPIE (*Rep. of Lab. R. C. P., Edin.*, 1894, **5**, 20—26; from *J. Anat. and Physiol.*, **27**, 195).—The properties of the compounds formed between proteïd matter and hydrochloric acid are in part described, and certain theoretical suggestions made concerning the mode of digestion of proteïds in the stomach.
W. D. H.

Influence of Fats on the Assimilation of Proteïds. By R. LAAS (*Zeit. physiol. Chem.*, 1894, **20**, 233—248).—The admixture of fat with proteïd food increases the nutritive value of the latter, more nitrogenous matter being assimilated. Fats, however, unlike carbohydrates, do not lessen the putrefactive changes in proteïd in the alimentary canal. W. D. H.

Metabolism. By I. MUNK (*Pflüger's Archiv*, 1894, **58**, 309—408). —This is a series of five papers, all relating to various important points in connection with nutrition. The methods employed are as a rule similar to those generally used in metabolism experiments, and the experiments and results are discussed with great fulness. The first series of experiments, performed on dogs, show the great sparing influence on proteïds exerted by gelatin. In a mixed diet, fully five-sixths of the proteïd may be replaced by gelatin.

The second set of experiments relates to the loss of material during the condition of inanition in a dog. They take into account not only the loss of organic material, but also of the inorganic salts, and cannot be explained otherwise than that the bones share in the wasting as well as the softer tissues.

The third section discusses certain points of detail in connection with the sparing influence of carbohydrates on proteïds, with special reference to putrefactive changes, as evidenced by ethereal hydrogen sulphates in the urine.

The fourth discusses the influence on metabolism of the division of the food into rations, and leads to the important practical conclusion that in man the food should be divided into at least three meals in order to make the best use of the nutriment administered.

The fifth and last section treats of a variety of points, chiefly criticising certain recent researches. Among these, those of Hirschfeld and others stand especially prominent, in which it has been stated that a smaller nitrogenous intake is compatible with healthy equilibrium than was formerly supposed to be the case. This is a very important consideration, as diet tables for soldiers, convicts, &c., may have to be considerably altered with economical advantage if Hirschfeld is right. The present paper, however, lends no support to Hirschfeld's ideas. It is admitted that there are considerable personal variations from the normal standard (Voit: 118 grams proteïd, 36 grams fat, and 500 grams carbohydrate *per diem*). This normal must not be slavishly followed in individual cases, but expresses an average, from which, however, the variations after all are not very great; hence it should form the basis for the construction of average diets for large numbers of people. W. D. H.

Influence of Carbonic Anhydride and Oxygen on Blood Coagulation. By A. E. WRIGHT (*Proc. Roy. Soc.*, 1894, **55**, 279—294).—The method used consisted in determining, by means of samples of blood withdrawn into capillary tubes, the alterations in the coagulability of the blood by altering the gaseous intake of living animals (dogs and rabbits). Increase of carbonic anhydride increases the rate of coagulation. The same is true for human blood in cases of hæmophilia. Diminution of the carbonic anhydride decreases the coagulability to the original normal. Decrease and increase of oxygen cause respectively decrease and increase of coagulability.

W. D. H.

Disappearance of Leucocytes from Blood after Peptone Injection. By D. Bruce (*Proc. Roy. Soc.*, 1894, **55**, 295—299).—Injection of peptone solution into the circulation of rabbits does not cause a destruction of leucocytes, but merely a withdrawal of them into various organs, notably the lungs and spleen. W. D. H.

Changes in Liver Cells. By T. L. Brunton and S. Delépine (*Proc. Roy. Soc.*, 1894, **55**, 424—438).—Various drugs were given to rabbits, and the effect on the liver cells noted. The compounds studied may be subdivided into three groups: (1) stimulating or excito-secretory, with pilocarpine for a type; (2) neutral; and (3) depresso-secretory, with atropine for a type. To the first group belong toluene, benzene, sodium iodide, pilocarpine, chrysophanic acid, ammonium chloride, metatolylenediamine, and nitric acid; to the second, aniline and phenol; to the third, phenol, atropine, and ammonia. The following caused marked increase in glycogen:—sodium iodide, metatolylenediamine, chrysophanic acid, toluene (?), ammonium chloride (?). The following did not do so, sometimes even causing a diminution of hepatic glycogen:—nitric acid, pilocarpine, benzene, and ammonium chloride (?). The following caused a marked diminution in the "free iron" in the liver:—sodium iodide, toluene, metatolylenediamine. The following caused a diminution of the "free iron," but in a less marked degree:—ammonium chloride, nitric acid, pilocarpine, benzene (in the fed liver); in the fasting liver, benzene causes a doubtful increase of iron. Ammonia causes a diminution of glycogen and an increase of iron. Atropine causes a slight diminution of glycogen and little change in the iron.

W. D. H.

Chemical Stimulation of Sensory Nerves. By P. Grützner (*Pflüger's Archiv*, 1894, **58**, 69—104).—It is well known from previous researches that the chemical stimulation of nervous structures produces different effects from other forms of stimulation. The present experiments confirm this statement, and are concerned with sensory nerves. The experiments fall into three categories—(1) on taste, (2) on reflex respiratory effects in animals, and (3) on pain in man. The chief results from the last of these three sets of experiments, which are given with greatest fulness, may be summarised as follows:—A wound in the finger having been made, solutions of various agents were applied to the exposed nerves, and the time at which pain was noticed, and the kind of pain experienced were noted. It was found that the pain reaction time for sodium iodide was 5, for an equivalent solution of sodium bromide 10, and of sodium chloride 50 seconds. The halogens themselves act in the reverse order, chlorine being the strongest stimulant. With potassium compounds, the chloride has the most, and the iodide the least intense action. Potassium hydroxide is stronger than sodium hydroxide, and ammonia, which has no action on motor nerves, is stronger than either. Ammonium chloride acts more strongly than sodium chloride, which is nearly inactive, but rather less strongly than potassium chloride. Cæsium chloride is stronger still. Rubidium chloride acts about the same as potassium chloride. The chlorides of calcium, strontium, and barium show no great difference; all give a burning sensation, the chloride of calcium being strongest and quickest in its action. The chlorides of zinc, cadmium, and mercury act in the order named, but less strongly and less quickly than those of the alkaline earths.

With regard to acids, there was found a pretty constant agreement between the acidity or avidity of the acids and their physiological action on sensory nerves; nitric and hydrochloric acids coming first, then sulphuric, and then, at a long interval, phosphoric.

Of the monhydric alcohols the lowest act most feebly; the corresponding fatty acids act in the reverse direction. Glycerol, which is such a strong stimulus for motor nerves, has practically no action on sensory nerves. W. D. H.

Chemical Stimulation of Ciliated Epithelium. By G. WEINLAND (*Pflüger's Archiv*, 1894, **58**, 105—132).—Ciliated epithelium from the frog's œsophagus was used; it was examined microscopically in solutions of various substances. Sodium fluoride acts most harmfully; then in order of molecular weight and harmful action come the iodide, bromide, and chloride. The potassium compounds of the halogens act similarly, although in a less degree; they are stronger stimuli of nerves. Ammonium chloride acts more feebly than potassium chloride. The chlorides of potassium, rubidium, and cæsium arrange themselves in their harmful action in the order of their equivalent weights; the chlorides of calcium, strontium, and barium in the opposite order, the last named even stimulating ciliary activity.

Potassium chlorate is intensely more harmful than the chloride.

Of the halogens themselves, iodine is the most, and chlorine the least harmful.

The alkalis first stimulate then lessen ciliary activity; this is most marked with sodium hydroxide, then potassium hydroxide, ammonia coming last. Calcium, strontium, and barium hydroxides are stimulating, especially the first named.

Small equivalent quantities of acids heighten at first the activity of the epithelium, and then destroy it. In this direction phosphoric acid is weakest, then hydrochloric, and then sulphuric. The fatty acids act harmfully in the order of their molecular weights, except that formic acid acts more strongly than acetic.

On the whole, the action of these chemical substances is similar to their action on motor nerves. W. D. H.

Rennet and similar Ferments. By R. PETERS (*Preisschrift, Rostock*, 1894).—By means of rennet, not only is the natural or artificial solution of caseinogen precipitable, but also solutions of caseïn, or boiled whey-proteïd, and various other proteïds of animal

and vegetable origin under certain conditions, of which the presence of calcium hydroxide is the most important. The precipitated proteïd can be dissolved, and is again precipitable by the ferment. Part of the proteïd, however, always remains in solution, due to splitting of the proteïd molecule, as Hammarsten showed. Ferments similar in their action are found in different parts of the vegetable kingdom.
W. D. H.

Colostrum of the Cow. By L. VAUDIN (*J. Pharm.*, 1894, [5], **30**, 337—339).—The following table gives the analytical results obtained.

	Just before calving.	Just after calving.				Five days after calving.
		1.	2.	3.	4.	
	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
Solids (dried at 95°)	27·615	24·49	27·356	22·47	24·17	14·37
Butter................	1·30	6·32	3·84	1·36	2·42	5·18
Lactose......	1·52	2·17	2·366	1·023	2·86	4·07
Ash (soluble)..........	0·278	0·250	0·220	0·271	0·190	0·26
,, (insoluble)........	0·809	0·839	0·830	0·791	1·02	0·51
Calcium phosphate	0·622	0·630	0·660	0·605	0·87	0·38
Proteïds	23·705	14·91	20·10	9·025	17·68	4·35
Acidity (as P_2O_5)	0·348	0·272	0·336	0·264	0·28	0·16

The lactose and butter are low before, and increase regularly after, calving. The ash or salts and proteïds are very high before calving, decreasing afterwards, but the ratio between them changes. The composition of the salts also varies, sulphates being present during and immediately after parturition, but not in normal milk.
L. T. T.

Albumoses in Serous Effusions. By A. L. GILLESPIE (*Rep. of Lab. R. C. P. Edin.*, 1894, **5**, 51—55).—About 20 different kinds of dropsical fluid were examined, and albumoses were found in nearly every specimen, peptone in a few, in addition to the proteïds usually described.
W. D. H.

Note by Abstractor.—These results are of but little value, as the albumin and globulin present were first removed by heat, an agency which would, of course, lead to the formation of these products of proteolysis.

Ethylic Sulphide in Dog's Urine. By J. J. ABEL (*Zeit. physiol. Chem.*, 1894, **20**, 253—279).—Dog's urine, which has been treated with milk of lime or free alkalis, yields a volatile substance which is absorbed by concentrated sulphuric acid, from which it can be again liberated by neutralisation. It was identified as ethylic sulphide. The compound with mercuric chloride melts at 119°, not at 90° as formerly stated. With nitro-sulphuric acid, it gives a deep green coloration. On oxidation with potassium permanganate in strong sulphuric acid solution, ethylic sulphide yields acetic and sulphuric acids, and not the sulphone. W. D. H.

Carbohydrates of Normal Urine. By K. BAISCH (*Zeit. physiol. Chem.*, 1894, **20**, 249—252; compare Abstr., 1893, ii, 542; 1894, ii, 393).—The carbohydrates of normal urine are three in number: *d*-glucose, animal gum, and a third which in former communications was not identified. The present research shows that this is probably isomaltose, a substance formed during digestive processes; it agrees with isomaltose in the following properties: reduction of Fehling's solution, non-fermentability with yeast, dextro-rotation, crystalline form, solubilities and melting point of its osazone. W. D. H.

Albuminuria. By F. D. BOYD (*Rep. of Lab. R. C. P. Edin.*, 1894, **5**, 79—84, 85—87, 88—102).—The total proteïds were estimated by boiling, the albumin by boiling after removal of the globulin by half saturation with ammonium sulphate, the globulin by difference.

Both proteïds are generally present; the proportion varies so much that it is not possible to diagnose the variety of kidney disease present by means of it. Even in amyloid degeneration, the globulin may not be in excess. In the albuminuria of pregnancy, the globulin is present in larger amount than in other forms of albuminuria. In the albuminuria of heart disease, the globulin is usually more abundant than in chronic interstitial nephritis. In acute nephritis, without hæmaturia, the two proteïds are about equal; but when blood is present the globulin is proportionally more abundant.

Four cases of Bright's disease are recorded in which serum albumin was present, but serum globulin absent, or present only in the merest traces; and one case where globulin and albumoses were present, but albumin absent. In no case did the proteïd quotient bear any relation to that of the blood. The amount of proteïd is often greater than that found in transudations. From these considerations, the presence of proteïd in the urine is considered to be due to secretion rather than transudation, and there is some evidence that the lower the state of nutrition of the renal epithelium the greater is the amount of globulin allowed to pass.

Some observations are recorded that confirm Posner's (*Virchow's Archiv*, **79**, 318) observations. The urine secreted by the Malpighian tufts is by many physiologists regarded as albuminous. The albumin is considered to be re-absorbed as the urine passes along the renal tubules in the normal condition. Posner took pieces of the kidney and plunged them into boiling water for two or three minutes; sections were then prepared. Where albuminuria had been present, the microscope revealed coagulated masses of proteïd in the capsule chambers and tubules, but when the healthy kidney, either of man or animals, was examined no such evidence of albumin was ever found. W. D. H.

Hæmoglobinuria. By A. L. GILLESPIE (*Rep. of Lab. R. C. P., Edin.*, 1894, **5**, 192—198; from *Edin. Med. J.*, June, 1892).—Clinical details of a case of paroxysmal hæmoglobinuria are given; the chief point of chemical interest is the observation that on one occasion the pigment present was not oxyhæmoglobin or methæmoglobin, as is usually the case, but acid hæmatin; or, at any rate, no reduction occurred on the addition of ammonium sulphide. The spectra of acid hæmatin and of methæmoglobin are, however, so similar that this evidence can hardly be regarded as conclusive since no measurements of the absorption bands are given. W. D. H.

Alcaptonuria. By H. V. OGDEN (*Zeit. physiol. Chem.*, 1894, **20**, 280—286).—A case of this disease is described. It agrees in all important points with those previously described by Baumann, Wolkow, and Embden. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Dialysis of Beer Yeast. By E. ONIMUS (*Compt. rend.*, **119**, 479—480).—A solution of beer yeast in pure water, or in a solution of sugar, is allowed to diffuse through parchment-paper into a solution of sugar in boiled water; after 15 to 20 minutes, the sugar in the latter solution is inverted, although no cellules, but only some microzymes, can be detected in it. It is only after two or three hours that small, isolated yeast cellules are observed in the sugar solution, and only after 11 or 12 hours that chains of cells can be detected. It follows that beer yeast secretes a dialysable substance, and that inversion of the sugar takes place without actual contact with the yeast cells. The medium is first modified by the zymase, and only after this alteration constitutes a nidus favourable to the development of cells. C. H. B.

Nitrifying Ferment. By G. TOLOMEI (*Staz. Sper. Agrar.*, 1894, **26**, 246—263).—After giving a short historical sketch of the subject of nitrification, the author describes his own experiments, which were mostly on the lines of those of previous investigators. It is concluded that nitrification is due to a micro-organism, that moisture is indispensable, that slight alkalinity is favourable, and that light, the chemically active rays, is prejudicial to the development of the organisms. Nitrification proceeds much more rapidly in porous than in compact substances, and is assisted by small quantities of ozone. Variations of temperature hinder nitrification. N. H. J. M.

Glutamine in the Green Parts of Plants. By E. SCHULZE (*Zeit. physiol. Chem.*, 1894, **20**, 327—334).—It has been previously shown that in the families Caryophyllaceæ and Filices no asparagine is found. It was therefore expected that glutamine occurred instead. The correctness of this hypothesis is shown by the experiments recorded in the present paper; further experiments show that glutamine is formed in the leaves. W. D. H.

Crystalline Nitrogenous Compounds in Seedlings. By E. SCHULZE (*Zeit. physiol. Chem.*, 1894, **20**, 306—326).—This is mainly a review of previous work. Different seedlings yield to analytical processes different nitrogenous crystalline products. Thus, in *Lupinus luteus*, asparagine, phenylalanine, amidovaleric acid, arginine, choline, and xanthine-like substances are found; in *Cucurbita pepo*, glutamine, asparagine, leucine, tyrosine, arginine, choline, vernine, and xanthine-like substances; in *Vicia sativa*, asparagine, phenylalanine, leucine, amidovaleric acid, guanidine, choline, and betaïne. This does not indicate that in plant metabolism the proteïd molecule breaks down in different ways, it being contended that the disintegrative metabolism of proteïd is qualitatively the same, but varies quantitatively. This is supported by experiments on plants of the same kind, only of different ages. It may also be that in some plants certain varieties of nitrogenous crystalline compounds are used more in nourishing the tissues, whilst in other plants other compounds are more advantageous, and so are used up first. W. D. H.

Analytical Chemistry.

Thioacetic acid as a Substitute for Hydrogen Sulphide in Qualitative Analysis. By R. SCHIFF and N. P. TARUGI (*Ber.*, 1894, **27**, 3437—3439).—Excellent results may be obtained by employing thioacetic acid instead of a current of hydrogen sulphide in qualitative analysis. About 2 c.c. of a 30 per cent. solution of ammonium thioacetate is simply added to the solution, made acid with hydrochloric acid in the usual way, and the liquid boiled. The reactions given by the metals appear to be identical with those obtained with hydrogen sulphide, but the time required for precipitation is greatly lessened. The only products of decomposition of the acid in the presence of hydrochloric acid are ammonium chloride, acetic acid, and hydrogen sulphide, so that the separation of the metals remaining unprecipitated is not interfered with. The reagent has been used for some time, and with great success, in the laboratories of the University of Pisa. A. H.

New Applications of Alkalimetry and Acidimetry. By F. HUNDESHAGEN (*Chem. Zeit.*, 1894, **18**, 505—506, 547).—*Estimation of the Hardness of Water.*—The reagents wanted are a solution of 3·786 grams of sodium carbonate in 1 litre of water and dilute nitric or hydrochloric acid of corresponding strength. 200 c.c. of the sample is titrated directly with this acid, tincture of cochinelle serving as indicator. Each c.c. of acid shows 1° of temporary hardness (German scale). The permanent hardness is estimated as follows. 200 c.c. of the sample is mixed with a moderate excess of the sodium carbonate solution, evaporated to dryness, and the residue, after being moistened with a little water, is once more evaporated and heated to about 200°. It is now dissolved in a little water, the liquid filtered, and the insoluble matter washed with about 50 c.c. of water. The filtrate is then titrated as before. The number of c.c. of acid deducted from the c.c. of added soda represents the permanent hardness. The total hardness may be estimated directly by using the resulting liquid from the estimation of the temporary hardness for the determination of the permanent hardness.

Volumetric Estimation of Phosphoric acid by Titrating the Yellow Precipitate.—The liquid should not contain more than 0·05 gram of phosphoric anhydride. If free hydrochloric or sulphuric acid is present, the phosphate is precipitated with a little ammonia and at once redissolved in nitric acid. After adding some ammonium nitrate and a little ammonium sulphate, the liquid is heated, precipitated with a slight excess of molybdate solution, and the precipitate collected and washed with a 1 per cent. solution of potassium nitrate, until the filtrate is practically neutral. The filter is then put back into the beaker, from 10 to 50 c.c. of water is added, and, after adding a few drops of 1 per cent. solution of phenolphthaleïn, the mixture is titrated with normal alkali until the precipitate has all dissolved, and the liquid turned permanently red. It is advisable to add a slight excess of the alkali, and then to titrate back with normal acid. 1 c.c. of normal alkali = 0·003077 gram of phosphoric anhydride.

Acidimetric Estimation of Tungstic acid.—The acid is separated in the usual manner, without troubling about any silica which may be present. The precipitate, after being washed, first by decantation, and then on the filter, with a 5—10 per cent. solution of potassium nitrate, is mixed with water, heated to boiling, and dissolved in excess of normal soda. The excess of alkali is titrated back with normal acid, phenolphthaleïn serving as indicator; 1 c.c. of normal alkali = 0·116 gram of tungstic anhydride. L. DE K.

Estimation of small Quantities of Chlorine in Fats. By R. BENEDIKT and H. ZIKES (*Chem. Zeit.*, 1894, **18**, 640—641).—A tube, made of hard glass, 100—110 cm. long and 11—12 mm. wide, is drawn out funnel shaped at one end and bent at an angle of 45° upwards. The funnel is provided with a doubly perforated india-rubber cork, through which passes a narrow bent tube for admitting air or carbonic anhydride, whilst the other hole admits a tube connected with a calibrated 100 c.c. reservoir containing the oil. The tube is made ready for use by introducing in the middle two separate 15—20 cm. layers of lime held together by plugs of asbestos. The empty space between the bend and the first plug of asbestos is filled up with broken pieces of porcelain. The tube is now laid in the combustion furnace, which must extend slightly beyond the second layer of lime. The other opening is closed with a cork through which passes a bent tube connected with a test-tube to collect any tar; another narrow tube carries off the gases, which must be lighted, and which indicate the progress of the combustion.

When the lime is red hot, the oil is very slowly admitted, a very slow current of carbonic anhydride being also passed through. When, after 3 to 5 hours, about 25—30 grams of oil has entered the tube, the supply is stopped, and, when the flame has gone out, the tube is allowed to cool; it is then emptied, and the contents examined for chlorine in the usual manner. The test analyses are very satisfactory. L. DE K.

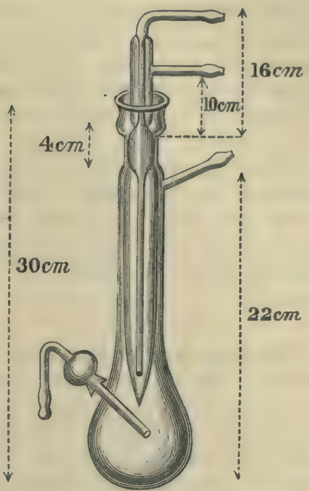
Estimation of Organic Nitrogen by Stock's Method. By C. E. ZAY (*Staz. Sper. Agrar.*, 1894, **26**, 22—31).—The nitrogen of several substances was determined by Kjeldahl's method (employing 20 c.c. of sulphuric acid containing 200 grams of phosphoric anhydride per litre) and by Stock's modification—using manganese dioxide (5 grams) with (1) sulphuric acid alone, and (2) with sulphuric acid containing phosphoric anhydride (20 c.c. per litre). Concordant results were obtained, and the employment of manganese dioxide effected a very great saving of time in the decomposition process. N. H. J. M.

Volumetric Estimation of Nitric acid. By D. MONNIER and H. AURIOL (*Chem. Centr.*, 1894, **24**, 1095—1096; from *Arch. sci. phys., Genève*, **31**, 352—358).—The process is based on the well-known principle that nitrates are reduced by nascent hydrogen. Sodium amalgam, prepared by adding 1 part of sodium to 100 parts of hot mercury, is allowed to act on the solution of the nitrate in the presence of tartaric acid. The hydrogen is collected and measured, and a check experiment is made with the same amount of amalgam without the nitrate. The difference of hydrogen evolved is the measure for calculating the amount of nitric acid. L. DE K.

Genuineness of Basic Slag. By F. SESTINI (*Staz. Sper. Agrar.*, 1894, **26**, 57—62).—Some samples of slag which the author had occasion to examine contained about 16 per cent. of total phosphoric anhydride and 4·4 to 5·8 per cent. soluble in dilute acetic acid (1 : 2), whilst the sp. gr., the amounts of water and of lime were about the same as are found in the case of normal slag. The results obtained indicate that the small amount of soluble phosphoric acid is not due to adulteration, but is connected with the amounts of ferric and ferrous oxide and alumina (about 3 per cent.) soluble in the same dilute acetic acid.

After discussing Wrampelmeyer's methods for the examination of basic slag (Abstr., 1894, ii, 119), the author points out that it is sometimes more difficult than was supposed to distinguish between an adulterated slag and one which owes its sparing solubility to its mode of production. The amount of ferrous oxide which a slag contains is of interest, as it does not occur in natural phosphates, and the different portions which can be separated from each other by levigation should be examined. N. H. J. M.

Estimation of Carbon in Steel. By H. KOCH (*Chem. Zeit.*, 1894, **18**, 485).—Air contained in a gasometer is first passed through a washbottle filled with sulphuric acid, then through two bottles containing solid potash; then comes an empty bottle, and, finally, one filled with sulphuric acid. The purified air then passes through the lower tube of the combustion flask, where it removes the carbonic anhydride and any hydrocarbons formed during the process, and it escapes through the upper tube. The gases are dried in a calcium chloride tube and completely burnt by passing them through a combustion tube containing red hot copper oxide. The resulting carbonic anhydride is first dried by passing it over calcium chloride and phosphoric anhydride, and then absorbed in a weighed potash apparatus to which is sealed a tube containing phosphoric anhydride. When required for the analysis of steel, the apparatus and combustion tube must first be completely freed from any carbonic acid or carbonaceous matter; the copper oxide is therefore heated to redness, a current of purified air being transmitted for some time. Into the flask is introduced 8 grams of chromic acid and 120 c.c. of dilute sulphuric acid (4 : 3) and the mixture boiled out. Afterwards 2 grams of the steel borings is introduced into the flask, the apparatus is connected with the combustion tube, and the operation conducted as usual. It will be noticed that the apparatus consists of two essential parts, the flask proper and a cooling contrivance. L. de K.



Height of flask, 30 cm.
Contents, 250 c.c.
Width of ground neck, 4 cm.

Sodium Cobalt Nitrite as a Reagent for Potassium. By J. van Eyk (*Chem. Centr.*, 1894, i, 1162; from *Nederl. Tijdsch. Pharm.*, **6**, 136—139).—The sodium cobalt nitrite is prepared by adding 100 c.c. of a 60 per cent. solution of sodium nitrite to a solution of cobalt nitrate (30 grams) in water (60 grams). After the evolution of nitric oxide has ceased, the mixture is filtered, and the salt precipitated with alcohol. By means of this salt, potassium can be detected when diluted to the extent of 1 : 10000. Ammonium salts are also precipitated by the reagent, but not until the concentration reaches 1 in 2000. E. C. R.

Assay of Nitre. By A. Hellich (*Chem. Zeit.*, 1894, **18**, 485—486).—The author has noticed that commercial nitre often contains perceptible quantities of perchlorates, and consequently should be tested for this impurity. Its presence, which is difficult to account for, has until now been ignored in the various schemes for nitre analysis. L. de K.

Estimation of Mercury in the Presence of Iodine. By François (*J. Pharm.*, 1894, [5], **30**, 249—254).—The estimation of mercury when combined in any form with iodine is easily effected by electrolysis. The salt need not be dissolved, but merely placed in the electrolysing vessel with the electrolyte. The latter may be dilute sulphuric acid, but the author finds the best electrolyte for this purpose to be formed by dissolving 20 grams of pure ammonium nitrate in concentrated pure ammonia, and making up with the latter to 100 c.c. The electrolysis is carried out in a platinum crucible of which the bottom is connected with the negative pole of the battery (two Bunsen cells). The positive pole is formed by a platinum rod, of which only about 1 mm. dips into the liquid. The mercury is deposited on the bottom of the crucible. When the action is finished, the solution is removed with a pipette, and the mercury is washed first with water and finally with alcohol, dried, and weighed with the crucible. The iodine in the solution is reduced with sulphurous acid, and estimated as silver iodide. This process may also be used for estimating mercury in the presence of bromine or chlorine. L. T. T.

Qualitative Separation of Chromium from Iron and Aluminium. By R. B. Riggs (*Amer. J. Sci.*, 1894, **287**, 409—411).—The mixed hydroxides or basic acetates containing about 0·1 gram of each metal are digested in 100 c.c. of water to which 10 c.c. of hydrogen peroxide and 1 gram of sodium hydroxide has been added, until effervescence ceases. After filtering off the iron, the liquid is slightly acidified with acetic acid, and the aluminium precipitated by ammonia. If the filtrate is yellow, this is a sure sign of the presence of chromium, which may, however, be confirmed, for instance, by the well-known hydrogen peroxide test. L. de K.

Apparatus for the Assay of Pyrolusite by Bunsen's Process. By C. Ullmann (*Chem. Zeit.*, 1894, **18**, 487).—A beaker filled with the requisite amount of solution of potassium iodide is placed on a block of wood of about the same height. In the beaker is placed a special apparatus to collect the chlorine, a kind of upright glass condenser, the inner tube of which is drawn out like a pipette, and the top of which is provided with a stopcock and funnel. The tube is filled by drawing out the air through the funnel and then closing the stopcock. The flask containing the sample and a sufficiency of hydrochloric acid is now connected with a doubly-bent delivery tube provided with a bulb. Heat is applied, and after the bulk of the air has collected in the apparatus, the chlorine enters, and is, of course, rapidly absorbed by the potassium iodide. When all the chlorine has been boiled off, the stopcock is opened, and the beaker is placed on the table. After rinsing the apparatus and delivering tube, the liberated iodine is titrated as usual with thiosulphate. L. de K.

Standardising Potassium Permanganate. By Miss C. F. Roberts (*Amer. J. Sci.*, 1894, **286**, 290—292).—The author recommends standardising potassium permanganate by means of a solution of ferrous chloride, made by dissolving a known quantity of electrolytically-prepared metallic iron.

About 10 grams of iron ammonium sulphate is dissolved in 150 c.c.

of water, 5 c.c. of a saturated solution of potassium oxalate is added, and the whole is then heated with a sufficiency of ammonium oxalate until a clear solution is obtained. This solution is then decomposed in a beaker between two platinum electrodes, the iron being deposited on a weighed piece of platinum foil of a size convenient to be inserted in a rather large weighing bottle. After about 1½ hours with a current of 2 ampères, a sufficient amount of metal will have precipitated, when it is washed and dried in the usual way. L. DE K.

Estimation of Iron in the Ash of Vegetable or Animal Matter. By M. RIPPER (*Chem. Zeit.*, 1894, **18**, 133—134).—The ash is dissolved in strong hydrochloric acid, the solution mixed with a few c.c. of hydrogen peroxide, and evaporated to dryness on the water bath; the residue is then just moistened with a few drops of hydrochloric acid, dissolved in about 20 c.c. of water, and transferred to a beaker. About 1·5 grams of potassium iodide is added, the beaker covered with a watch glass, and heated for 10 minutes at 60°; the liberated iodine is then titrated in the usual manner with N/100 sodium thiosulphate.

The process, which hitherto has only been used for the estimation of fairly large quantities of iron, only occupies one or two hours, and compares favourably with the gravimetric methods. L. DE K.

Electrolytic Separation of Iron and Cobalt from Zinc. By G. VORTMANN (*Chem. Centr.*, 1894, i, 877; see Abstr., 1894, ii, 34).—In separating iron from zinc by the electrolysis of an alkaline tartrate solution, only a single accumulator, giving a current of 0·07—0·1 ampère, should be used instead of the two formerly recommended; it then becomes unnecessary to redissolve the iron, since it is deposited free from zinc. The electrolysis should be commenced in the cold, but towards the end a temperature of 50—60° promotes the deposition. The cathode (a disc of platinum, silver, or silvered copper, 50 mm. in diameter) should be from time to time replaced by a new one, and the operation continued as long as any gain in weight takes place. After the removal of the iron from the solution, the zinc is deposited by using two accumulators in series, with an E.M.F. of 4 volts.

Cobalt is also better separated from zinc in an alkaline tartrate solution by using 2 volts than by 4. Addition of potassium iodide diminishes the deposition of cobaltic oxide on the anode, but as this cannot be completely prevented the anode must likewise be weighed. The operation is performed as for iron, but with a warm solution.

M. J. S.

Separation of Arsenic, Tin, or Antimony from Lead, Copper, Silver, Cadmium, Cobalt, Nickel, &c. By P. JANNASCH (*Ber.*, 1894, **27**, 3335—3336).—Elements, such as arsenic and tin, the chlorides of which are comparatively volatile, may be separated from other metals by dissolving the mixture in nitric acid or aqua regia in a special glass vessel, evaporating, and heating the residue at a suitable temperature in a current of dry hydrogen chloride, the vessel being placed in a nickel air bath, which can be heated up to 450°;

the more volatile chlorides distil over, and are collected. Details of the apparatus were given in a previous paper (Abstr., 1894, ii, 330).

C. F. B.

Action of Organic Matters on Potassium Permanganate. By A. ZEGA (*Chem. Zeit.*, 1894, **18**, 2—3).—The author has proved that trustworthy, comparable results in the titration of organic matters contained in potable waters may be obtained by operating in the following manner.

50 c.c. of the sample is put into a 100 c.c. flask, mixed with 5 c.c. of the usual permanganate solution, 5 c.c. of dilute sulphuric acid (1 : 2) added, and the mixture heated for 20 minutes on a water bath; the excess of permanganate is then titrated back by oxalic acid. The process is particularly useful when the water contains volatile organic matters. The standard permanganate is checked under the same conditions.

L. DE K.

Analysis of Petroleums. By A. RICHE and G. HALPHEN (*J. Pharm.*, 1894, [5], **30**, 289—300).—The object of this work was to find methods for distinguishing (*a*) between petroleums of Russian and American origin, and (*b*) between crude oils, and mixtures of refined and residual oils. As a rule, the Russian oils contain less volatile oils and are denser than the American; for fractions of the same boiling point, Russian oils are generally denser than American, the mean sp. gr. of the fraction 140—160°, for example, being, for Russian oils 0·782, and for American 0·755. The refractive indices vary directly with the sp. gr., and so for fractions of the same boiling point are higher for Russian than for American oils. Russian oils are generally poorer in light oils and richer in heavy oils than American, whilst the latter are richer in solid paraffins, and are often rendered turbid by cold from separation of these substances. The American petroleums are generally almost exclusively composed of saturated hydrocarbons, whilst the heavier portions of the Russian oils generally contain hydrocarbons of the C_nH_{2n} series. None of these differences are, however, sufficiently certain to form satisfactory bases for analysis.

The authors have found the best test to be the solubility of the oils in a mixture of equal volumes of chloroform and alcohol. 4 grams of the refined petroleum to be tested (of which the density at 15° has already been determined) is introduced into a flask, and the alcohol-chloroform mixture gradually added from a burette until the liquid, which is at first rendered turbid, again becomes clear; the quantity of solution required is then noted. The fractions chosen should be those of about sp. gr. 0·800 to 0·830, as at these densities the difference is most marked. Thus, for sp. gr. 0·820 American refined oils required from 8 to 11 c.c. of the alcohol-chloroform for solution, the mean being 9·5 c.c., whilst for Russian oils the numbers were 4·3 to 4·8 c.c., giving a mean of 4·5 c.c.

For crude oils, a much larger amount of solvent is required; Russian crude oils of sp. gr. 0·851 to 0·877 requiring about 15 c.c., whilst refined oils of the same sp. gr., or mixtures of refined oils with about 10 per cent. of residuals, only required from 4 to 5 c.c. With

American crude oils, of which the sp. gr. varies from 0·788 to 0·822, the solvent required also amounts to about 15 c.c., whilst with the same oils refined, or mixtures of refined with residuals, from 5 to 7 c.c. only are required. A few of the very light American crude oils (of about 0·785 sp. gr.) require much less of the solvent.

Full tables and curves of solubility are given in the paper, and a special form of burette for keeping the alcohol-chloroform out of contact with the air is described. L. T. T.

Assay of Ethereal Oils. By J. Klimont (*Chem. Zeit.*, 1894, **18**, 641—642; 672—673).—The author's process is based on the fact that ethereal oils react strongly with bromine, whilst paraffin oil gives scarcely any reaction. For the assay of oil of turpentine, for instance, the following reagents are required. Solution of bromine in chloroform of about 1 per cent. strength; pure chloroform, treated with strong sulphuric acid, washed, and redistilled; pure turpentine, made by first washing oil of turpentine with aqueous soda, and afterwards collecting the fraction distilling over at 168—170°. 0·5 c.c. of this is put into a stoppered 20 c.c. flask and accurately weighed; chloroform is then poured in up to the mark, and the solution put into a little burette. 10 c.c. of the bromine solution is introduced into another little flask, and the turpentine solution slowly added until the colour of the bromine has entirely disappeared. If now a suspected sample of turpentine is at once treated in the same way as the pure specimen, its lesser bromine-decolorising power will indicate a more or less marked adulteration.

The author has tabulated the results of experiments with almost every known ethereal oil, including 9 specimens of refined turpentine and 11 of inferior brands; also experiments with adulterants, such as resin oil and petroleum. The figures given are not bromine numbers, but represent the equivalent amount of turpentine. L. de K.

Detection of Methylated Spirit in Tinctures, &c. By A. Ashby (*Analyst*, **19**, 261—271).—The author has satisfied himself that, of the numerous methods proposed, the test with sodium nitroprusside in the presence of ammonia is the best. The red colour will appear within 10 or 15 minutes. The constituent the reaction is chiefly due to has yet to be ascertained.

When examining alcoholic liquids free from solid matter, the test may be applied directly by mixing the sample with an equal bulk of a 1 per cent. solution of sodium nitroprusside and adding a few drops of ammonia; but in the case of officinal tinctures, 25 c.c. of the sample is distilled, and the first 5 c.c. which pass over tested. Ethereal solutions are distilled to dryness, and successive portions of the distillate are tested; if, however, the sample is very weak in spirit, it is best to add 2 or 3 c.c. of strong, pure alcohol to the distillate before applying the test. If the not very probable presence of a sulphide be suspected, it is best to add some fixed alkali before distilling.

L. de K.

Gravimetric Estimation of Sugar by means of Alkaline Copper Solutions. By L. Grünhut (*Chem. Zeit.*, 1894, **18**, 447—

448).—Owing to the great difficulty of completely oxidising cuprous oxide, the results obtained by weighing the copper oxide are often much too low; weighing as cuprous oxide on a filter has also its disadvantages.

The author strongly recommends the process wherein the cuprous oxide is collected on a weighed asbestos filter contained in a glass tube. After first igniting in a current of air to burn off organic matters, the oxide is reduced in a current of dry hydrogen and the residual metal finally weighed. L. DE K.

Gravimetric Estimation of Glucose. By F. GAUD (*Compt. rend.*, **119**, 478—479).—50 c.c. of the freshly-prepared alkaline copper solution is mixed with an equal volume of water, boiled for a few minutes in a porcelain dish, and then placed on a water bath, the water in which is boiling; 25 c.c. of the sugar solution, containing about 1 per cent. of glucose, is then added all at once. Reduction under these circumstances takes place below 100°, a condition which is essential to prevent the destructive action of the alkali on the glucose. After 10 minutes, reduction being complete, the liquid, which should have a deep blue colour, is decanted off, and the precipitate is washed with boiled water until the washings are no longer alkaline to phenolphthaleïn. The precipitate is then transferred to a sp. gr. bottle holding 20 to 25 c.c., the capacity of which at 0° is known, and the bottle is filled up to the mark with boiled water and weighed at a temperature t.

Let P be the weight of the liquid and precipitate, the total volume of which is equal to the capacity of the flask at the temperature t, that is to say, $V_t = V_0[1 + 3\beta(t - t_0)]$. The sp. gr. of dried cuprous oxide is $\Delta = 5{\cdot}881$, and the sp. gr., d, of water at the temperature t is known; then the weight p of cuprous oxide is given by the expression

$$p = \frac{P - V_t d}{1 - d/\Delta}.$$

To obtain perfect results, the weight P should be reduced to a vacuum. The change in the sp. gr. of cuprous oxide caused by ordinary changes of temperature is too small to affect the result.

The weight of cuprous oxide is not strictly proportional to the weight of glucose present, and it is necessary to prepare a table showing the relation between various values of the two numbers. The author obtained the following results.

Cuprous oxide. Milligrams.	Glucose. Milligrams.	Cuprous oxide. Milligrams.	Glucose. Milligrams.
10	5·413	100	46·22
20	9·761	200	91·047
30	14·197	300	138·842
50	23·036	400	188·928

C. H. B.

Modification of the Copper Test for Glucose. By ALLEIN and F. GAUD (*J. Pharm.*, 1894, [5], **30**, 305—307).—The authors find (this vol., i, 123) that the free potash or soda in Fehling solution causes the decomposition of a part of the glucose to be estimated, and thus causes the low results known to be obtained by that method. The following solution gives results free from this error. 8·7916 grams of pure (electrically deposited) copper is dissolved in 93 grams of sulphuric acid, the solution is diluted with its own volume of water, and the whole made up to 1000 c.c. with strong ammonia. A deep blue solution is thus obtained, which is perfectly stable, and of which 10 c.c. corresponds with 0·05 gram of glucose. The estimation is conducted in a flask fitted with a triple-bored cork to admit the end of the burette containing the glucose solution and tubes for passing a current of hydrogen. 10 c.c. of the ammonio-copper solution and 10 c.c. of ammonia are introduced into the flask on a water bath, and heated to about 80°, and the liquid containing the glucose is then added drop by drop until the solution becomes colourless. If desired, the solution may be reoxidised (by substituting a stream of air for that of hydrogen as long as the reproduced blue colour deepens) and a second estimation be then performed. The cuprous oxide dissolving in the ammonia to a clear, colourless solution, renders the end of the reaction very sharp and exact. L. T. T.

Note.—No reference is made to the earlier processes of Pavy and others, in which ammoniacal copper solutions are employed.—EDITORS.

Estimation of Crystallisable Sugar in Raw Sugars. By M. KARCZ (*Chem. Centr.*, 1894, **17**, 845—846; from *Zeit. Zuck. Ind.*, **23**, 21—24).—Thirty or fifty grams of the sample is mixed in a dish with an equal weight of absolute glycerol, and placed for some time in a desiccator. The glycerol soon dissolves the adhering syrup, but leaves the crystals intact. After pouring the glycerol into a glass funnel filled with cotton wool, and provided with a cover containing a calcium chloride tube, an aliquot part of the filtrate is examined in the polariscope. The polarisation deducted from that of the original raw sugar gives the amount of crystallisable cane sugar in the sample. L. DE K.

Estimation of Cane Sugar in Beer Wort. By K. AMTHOR (*Chem. Centr.*, 1894, i, 932—933; from *Zeit. Nahrungsmittelunters. Hygiene*, **8**, 80—81).—A criticism of Jais' process (Abstr., 1894, ii, 123). Whereas Jais, in estimating the maltose and inverted sugar, boils for only two minutes, the reduction tables are constructed for an ebullition of four minutes, which yields higher results. Moreover, the hydrochloric acid used attacks constituents of the wort other than cane sugar, and augments their reducing power. M. J. S.

Estimation of Starch in Compressed Yeast. By F. FILSINGER (*Chem. Zeit.*, 1894, **18**, 742).—Twenty to thirty grams of the sample is rubbed with 250 c.c. of water, and mixed with excess of a solution of iodine in potassium iodide; the starch combines with the iodine, and forms a comparatively heavy compound, which settles long before any appreciable quantity of yeast has gone down. The milky liquid is syphoned off, and the iodide of starch repeatedly lixiviated with water until all the yeast cells have been removed. The starch is finally collected on a weighed filter, dried at 105°, and weighed. The iodine is practically expelled during the heating. In calculating the percentage, it must be remembered that commercial potato starch generally contains 15 per cent. of water.

The test analyses are very satisfactory. When, however, the amount of starch is below 10 per cent., the results will be somewhat too low.
L. DE K.

Estimation of Carbohydrates. By E. SCHULZE (*Chem. Zeit.*, 1894, **18**, 527—528).—The author points out that if carbohydrates, on boiling with dilute sulphuric acid, yield other products besides dextrose, the action of the acid should not be unduly prolonged. If a mixture of carbohydrates be inverted, it is almost impossible to get a good result, as some of them may already have become largely decomposed before the inversion of the others is anything like complete.
L. DE K.

Separation of Uric acid, Adenine, and Hypoxanthine. By M. KRÜGER (*Zeit. physiol. Chem.*, 1894, **20**, 170—175).—In a hot solution containing the three substances, copper sulphate and sodium thiosulphate precipitate only adenine and hypoxanthine. In a cold solution of these two substances, the same reagents precipitate adenine only.
W. D. H.

Estimation of Xanthine-like Substances in Urine. By M. KRÜGER and C. WULFF (*Zeit. physiol. Chem.*, 1894, **20**, 176—185).—The new name alloxuric substances is suggested for those of the uric acid group. The alloxuric bases which occur in small quantities in urine are xanthine, guanine, hypoxanthine, carnine, paraxanthine, and heteroxanthine; a specific reagent for their precipitation is a mixture of copper sulphate with sodium hydrogen sulphite, but it also precipitates uric acid. 100 c.c. of urine is precipitated with 10 c.c. of these reagents, and the precipitate allowed to collect for two hours. Uric acid is separately determined in another sample of urine. The absolute amount of the nitrogen in this precipitate varies from 2·6 to 8 milligrams per 100 c.c. of urine, the average being 4·53.

The proportion of uric acid nitrogen to the nitrogen of the alloxuric bases varies from 2·1 : 1 to 7·6 : 1. The mean of 19 analyses gives 3·82 : 1. The average uric acid nitrogen in the 24 hours is 0·2333 gram; and of nitrogen in alloxuric bases, 0·0481 gram.
W. D. H.

Estimation of Acidity in Milk. By M. SCHAFFER (*Staz. Sper. Agrar.*, 1894, **26**, 164—167; from *Bern. Blätter f. Landw.*).—The apparatus used in the method described, which is a modification of the Soxhlet-Henkel method, consists of two cylindrical bulbs connected by a narrow graduated tube. The lower bulb holds just 50 c.c., and is provided at its lower end with a small bulb, holding 2 c.c. The upper of the two large bulbs is of about the same size as the lower, and is stoppered. In making a determination, 2 c.c. of phenolphthaleïn solution is poured into the apparatus (filling the lowest portion of the apparatus), then the milk to be examined, until it reaches the 50 c.c. mark, and lastly, $\frac{1}{4}$ normal soda solution (2—2·5 c.c.). The apparatus is then corked, and the contents mixed. More soda is gradually added until alkalinity is produced. The amount of alkali added is read off in the narrow tube. In mixing the alkali, the apparatus must not be shaken (as froth would be produced), but so inclined that the liquid runs into the upper bulb.

The method is of use in ascertaining whether milk is sufficiently free from acid to keep. It will probably also be of use in testing milk intended for cheese-making, and will furnish evidence of milk having been more or less skimmed (since milk always becomes more acid when left at rest), and the presence of such milk as an adulterant. N. H. J. M.

Soxhlet's Areometric Estimation of Fat in Milk. By H. TIMPE (*Chem. Zeit.*, 1894, **18**, 392—394).—This deservedly popular process has one great inconvenience, namely, that the ether sometimes refuses to properly separate from the alkaline solution, so that only a small amount can be drawn off.

The author now recommends that the sample of milk should first be diluted with three volumes of water. The ethereal layer then separates with the greatest ease. L. DE K.

Loss of Total Solids in Milk on Keeping. By E. J. BEVAN (*Analyst*, **19**, 241—244).—The author accidentally noticed that milk placed in the usual weighing dishes will, if not soon evaporated, yield a residue which may be as much as 1 per cent. too low. If immediately before evaporation the milk is carefully neutralised with N/10 soda, the loss will not be so great, owing to the formation of a stable lactate. Contrary to Bell's statement, the author finds lactic acid to be sensibly volatile in the presence of water. The results of several experiments are tabulated, and show the disproportion between the acidity and the loss in total solids. L. DE K.

Periodic Estimation of Volatile Fatty Acids in the Butter produced during a Year. By L. CANTONI and L. CARCANO (*Staz. Sper. Agrar.*, 1894, **26**, 131—137).—With the view of ascertaining the causes of the variations in the amount of volatile fatty acids in butter, samples of butter from three dairies were examined weekly for a year. The results, which are given in tables, do not show any great differences or regularity. This is, perhaps, due to the fact that in the Lombardy dairies calving does not take place at definite periods, and a kind of compensation may thus take place between conditions which raise and lower respectively the amount of volatile fatty acids.

A table is also given showing the results of experiments with Zeiss' butter-refractometer as well as the volatile fatty acids.

N. H. J. M.

Modification of the Reichert-Meissl Butter Process. By C. BÜNTE (*Chem. Zeit.*, 1894, **18**, 204—206).—The author criticises the sulphuric acid process lately proposed by Kreiss and modified by others, and has finally adopted the following plan. 5 grams of butter-fat is introduced into an Erlenmeyer litre flask, and heated for a time in a drying oven at 100°; 10 c.c. of sulphuric acid (sp. gr. 1·8355) is added, and the mixture well agitated until all the fat has dissolved. The flask is now put into water at 30—32° for 10 minutes; 150 c.c. of water is added, and then strong solution of potassium permanganate until the liquid acquires a transitory pink colour. The liquid is then subjected to the usual distillation and titration.

L. DE K.

Estimation of Lecithin in Plants. By E. SCHULZE (*Zeit. physiol. Chem.*, 1894, **20**, 225—232, 252).—A critical reply to v. Bitto in reference to his method (Abstr., 1894, ii, 402). W. D. H.

Analysis of India-rubber Wares. By R. HENRIQUES (*Chem. Zeit.*, 1894, **18**, 411—412, 441—444; compare Abstr., 1892, ii, 399). —The author gives further instructions for the analysis of rubber wares. Adulteration with fatty matter or fatty surrogate (*faktis*) may be detected by treating a weighed quantity of the sample with alcoholic soda, as previously described, and noticing the loss in weight. If the sample contains much added mineral matter, it is best to first treat it with moderately strong acid before boiling with the alkali; as the latter dissolves small quantities of rubber, a correction must be made by deducting from the weight of the surrogate a quantity corresponding with 2·5 per cent. of the rubber actually found; soluble sulphur is, of course, allowed for. Asphalt, whether true bitumen or the artificial product, is another adulterant. In the absence of surrogate, 1 gram of the finely-divided sample is soaked for an hour in 30 c.c. of nitrobenzene. The insoluble mass is thrown upon a filter, gently pressed with a small pestle, and further washed with another 30 c.c. of the solvent; the mass is then transferred by means of a wash-bottle to a porcelain dish and boiled with water until all odour of nitrobenzene has disappeared; it is then dried and weighed. As rubber is not altogether insoluble in nitrobenzene, a correction must be made by deducting 2·5 per cent. from the asphalt for true rubber dissolved; soluble sulphur must also be allowed for. If the sample contains also oil surrogate, this must be first removed by treatment with alkali, in which asphalt is practically insoluble. The process becomes still more complicated if, besides asphalt, lamp-black is also present; this withstands the action of all ordinary solvents, and remains in consequence with the rubber. The author has found that in pure rubber there is a fairly constant atomic relation between the hydrogen and the carbon, which may be taken as 16 : 10. The residue containing the rubber + the lamp-black is therefore submitted to an organic combustion, and any excess of carbon put down to lamp-black.

The test analyses given by the author are remarkably satisfactory considering the nature of the analysis. The process does not, as yet, provide for a host of other possible adulterants. L. DE K.

General and Physical Chemistry.

Indices of Refraction of Solutions of Sulphur and Phosphorus in Carbon Disulphide. By V. Berghoff (*Zeit. physikal. Chem.*, 1894, **15**, 422—436).—The indices of refraction of solutions of sulphur in carbon bisulphide for sodium light were determined at two different temperatures, 3·5° and 22·7°. The results are contained in the following table, the first column of which gives the concentrations of the solutions as the number of parts by weight of sulphur contained in 100 parts of carbon bisulphide.

	$n_{3·5}$.	$n_{22·7}$.	Diff. for 1°.	n_{15} cal.
0	1·64143	1·62522	8443	1·63172
5	1·65153	1·63668	7735	1·64264
10	1·66175	1·64704	7662	1·65294
15	1·67170	1·65772	7281	1·66333
20	1·68105	1·66643	7647	1·67232
25	1·69073	1·67564	7860	1·68169

Solutions of phosphorus in carbon bisulphide were examined only at 20·7°. The numbers obtained were as follows.

Conc.	$n_{20·7}$.
0	1·62697
5	1·64012
10	1·65216
15	1·66517
20	1·67628
25	1·68646

The sulphur solutions give constant values for the expression $(n - 1)/d$, but not for $(n^2 - 1)/d(n^2 + 2)$. Temperature appears to have little or no influence on the values of $(n - 1)/d$. H. C.

Saturated Hydrocarbons containing the Active Amyl Radicle. By Miss I. Welt (*Compt. rend.*, **119**, 743—747).—Ethylamyl, propylamyl, isobutylamyl, and diamyl were prepared by the action of sodium on mixtures of the appropriate alkylic iodides. When necessary, corrections were made for the small quantities of alkylic iodides present in the hydrocarbon. The rotatory powers are as follows.

	Low temperature.		High temperature.	
	t.	$[\alpha]_D$.	*t.*	$[\alpha]_D$.
Ethylamyl	17°	+ 6·23 to + 6·43	60°	+ 6·09
Propylamyl	16	+ 6·44	54	+ 6·25
Isobutylamyl	20	+ 5·88	51	+ 5·66
Diamyl	17	+11·95	—	—
Diamyl	21	+12·08	78	+12·06

All the hydrocarbons are dextrogyrate, and the rotatory power is only slightly affected by the temperature, although it tends to diminish. In the case of the hydrocarbons containing one asymmetric carbon, the rotatory power passes through a maximum, the exact position of which is not yet determined, although the calculated maximum corresponds with pentylamyl. The rotatory power of diamyl is nearly double that of the hydrocarbons containing only one amyl group, which is in agreement with the views of Guye and Gautier.
C. H. B.

Attempts to Resolve Unsaturated Compounds into Optically Active Constituents. By A. LE BEL (*Bull. Soc. Chim.*, 1894, [3], **11**, 292—295).—The fact that the naturally occurring ethylene derivatives are optically inactive has tended hitherto to divert inquiry from the possibility of their activity. It is quite feasible, however, that by substituting sufficiently heavy groups for two of the hydrogen atoms in the ethylene molecule the latter might be caused to suffer sufficient deformation to give rise to such activity. A somewhat analogous case occurs in the series of diamine platinochlorides, the crystalline forms of which undergo modification as the molecular weight increases, this modification being probably due to internal stereometric rearrangement of the molecules.

The results of experiment, however, fail to confirm any such supposition. Both allylic alcohol and ammonium α-crotonate (from β-hydroxybutyric acid) fail to show any signs of differentiation into optically active modifications when used as culture-media for moulds. Maleïc and fumaric acids also yield practically inactive products. Mesaconic and citraconic acids at first seemed to give decisive evidence in favour of the theory, as the former yielded a dextrogyrate, the latter a lævogyrate, product when subjected to the abovementioned process. In one experiment, 400 grams of citraconic acid in weak aqueous solution (0·2 per cent.) yielded a product, the methylic salt of which proved to be distinctly lævogyrate. As, however, the activity was found to reside in the least volatile portion, it was probably due to an impurity, and on repeating the experiment with slight modifications on a larger quantity (1400 grams), the impurity was isolated as a liquid which boiled at about 140°, and gave rise to a rotation of $-10°$ per 10 cm. It proved on analysis to be *methylic methylmalate*, COOMe·CHMe·CH(OH)·COOMe, formed by hydration of the citraconate. The more volatile portion was also active, but proved on analysis to consist of a mixture of the citraconate and methylmalate. The results of the experiments with mesaconic and citraconic acids must, therefore, also be taken as negative, and the molecules of the simpler of the ethylene derivatives, at all events, must continue to be represented by plane formulæ.
JN. W.

Rotatory Powers of Disubstituted Alkylic Tartrates. By P. FREUNDLER (*Bull. Soc. Chim.*, 1894, [3], **11**, 305—317).—See this vol., i, 173.

Determination of the Molecular Weight of Liquids. By P. A. Guye (*Compt. rend.*, 1894, **119**, 852—854).—The ratio of the molecular refraction to the critical coefficient (absolute critical temperature divided by the critical pressure) should theoretically be about 1·8. On the other hand, the quantity f given by the equation

$$f = \frac{(\log p_c - \log p)}{T_c - T}\,T,$$

where p_c and T_c are the critical pressure and absolute critical temperature, and p and T any other pressure and corresponding temperature, should have the value 2·8 to 3·1 if the molecule in the liquid state is of the same weight as the molecule at the critical point, or the value 3·2 to 4·1 if polymerisation has taken place. The author has calculated the values of the above two quantities for a number of liquid hydrocarbons, and comes to the conclusion that these have the same molecular weight in the liquid as in the gaseous state.

H. C.

Scientific Electro-chemistry of the Present, and Technical Electro-chemistry of the Future. By W. Ostwald (*Zeit. physikal. Chem.*, 1894, **15**, 409—421).—A popular address to the German Electrotechnical Association. The author deals with the modern theories of electro-chemistry, and points to technical improvements for the future, more particularly in the construction of secondary batteries, and the direct conversion of the energy of burning coal into electricity.

H. C.

Thermoelectric Properties of Pure Metals. By K. Noll (*Ann. Phys. Chem.*, 1894, [2], **53**, 874—911).—Owing to considerable differences between the observations of different workers on the thermoelectric properties of metals, the author redetermines the electromotive force for various combinations, employing metals in as high a state of purity as was obtainable. In the first series of experiments, the second metal was in all cases mercury, and the temperatures of the junctions 100° and 0°. The E.M.F. was determined by Du Bois Raymond's modification of Poggendorf's methods, Clarke cells being employed as the source of the constant E.M.F. The results of these researches (expressed in microvolts) are contained in the following table, + values indicating a current from mercury to metal at the hot junction.

Bismuth	−6705·4	Carbon rod	+ 662·88
Nickel	−1664·2	Silver	+ 710·25
Cobalt	−1522·2	Gold	+ 713·35
Nickel silver	−1085·2	Copper	+ 725·58
Platinum	+ 4·59	Zinc	+ 692·71
Aluminium	+ 362·4	Cadmium	+ 875·09
Magnesium	+ 391·84	Carbon filament	+1452
Tin	+ 396·03	Iron	+1601·4
Lead	+ 402·5	Piano wire	+1732·3
Brass	+ 443·31	Antimony	+3379·6

In many cases the effect of small quantities of impurity was very great. Thus platinum gave values as high as +593·88, and copper as low as +684·29 when the metals were not chemically pure. The state of aggregation had also a marked effect in some cases, for instance, silver (710·25; 671·51), zinc (692·71; 735·2), iron, brass, nickel. The second series of experiments was performed at various temperatures between 217° and 0°, a number of experiments being made in each case. From the results, the value for 100—0° was calculated, good agreement with the observed value being in all cases obtained. The junctions were in some cases formed with mercury, in others with copper. The electromotive force is given according to Gaugain by formula $\epsilon = (t_1 - t_2)\{b \pm c(t_1 + t_2)\}$. The values for b and c are deduced from two experiments, and the results calculated by their aid compared with the observations. The agreement is perfectly satisfactory. The value $\frac{d\epsilon}{dt} = b \pm ct$ is then calculated, and as this can be expressed as $b \pm (k_2 - k_1)\,t$, where k_2 and k_1 are the constants for the different metals of the junction, the numbers are referred to lead for which $k = 0$. The values thus obtained for the thermoelectric power $\frac{d\epsilon}{dt}$ are compared with those of other observers. The difference in the result may be explained by the effect of impurities which, as is evident from the numbers, produce considerable variations.

L. M. J.

Conductivity of Aqueous Solutions of Carbonic Anhydride. By W. F. Knox (*Ann. Phys. Chem.*, 1894, [2], **54**, 44—57).—Kohlrausch's method was employed for the determination of the conductivity, and a number of experiments at varying pressures were made, the results being recorded for both rising and falling pressures. As the temperature was not constant, varying to the extent of about a degree, the results were reduced to constant temperature by use of the formula $\frac{dk}{dt} = \frac{\delta k}{\delta t} + \frac{\delta k}{\delta Q} \cdot \frac{\delta Q}{\delta t}$, where Q is the quantity of carbonic anhydride dissolved. This reduced to $\frac{dk}{k} = \frac{1}{k}\frac{\delta k}{\delta t} \cdot dt + \frac{1}{2Q} \cdot \frac{\delta Q}{\delta t} \cdot dt$. The value for the latter term is found to be −0·0169 at 12·5 and −0·0099 at 18°, and for the former 0·0300 and 0·0257 for the same temperatures, which are those to which the results are reduced. Tables are then given of the reduced numbers, corrections being also made for the conductivity of pure water. If m is the equivalent ($\frac{1}{2}CO_2$) content per litre, then $k/\sqrt{m}$ should be approximately constant. The value for this expression is determined, a variation of from 121 to 139 being observed at 12·5°, and of from 144 to 159 at 18°; the value for m, however, varying between 0·002 and 0·2. If also the value for the most dilute solution is neglected, the numbers at 18° only vary between 147 and 144. The time taken to saturate water by passing a stream of carbonic anhydride through it was also observed, together with the time required to free it from the gas by a current of air. In the latter case the curve of decrease of saturation is approximately logarithmic. The author points out that the increase in conductivity of pure water when exposed to the air is probably due to the solution of carbonic anhydride (compare Abstr., 1894, ii, 375). L. M. J.

Heat of Vaporisation of Saturated Fatty Alcohols. By W. Louguinine (*Compt. rend.*, 1894, **119**, 601—604).—The alcohols were carefully purified, and precautions were taken to exclude moisture at every stage of the operations. The method adopted was similar to that of Regnault, but only 100 c.c. of liquid was employed. The differences between the author's results and those of previous observers, is probably due to the care taken to exclude moisture. In the case of isopropylic alcohol and isobutylic alcohol, it was assumed that the specific heat of the liquid is the same as for the corresponding normal alcohol, and that the specific heat of dimethylethylcarbinol is the same as that of fermentation amylic alcohol. The results are as follows, the determinations being made under a pressure of 745—755 mm.

Ethylic alcohol	201·42	cal.
Normal propylic alcohol	164·07	„
Isopropylic alcohol.............	159·72	„
Normal butylic alcohol	138·18	„
Isobutylic alcohol	136·16	„
Amylic alcohol (fermentation)..	118·15	„
Dimethylethylcarbinol.........	110·37	„

C. H. B.

Trouton's Law and the Saturated Fatty Alcohols. By W. Louguinine (*Compt. rend.*, 1894, **119**, 645—647).—Trouton's law, that the product of the molecular weights of substances into their latent heats of vaporisation, divided by their boiling points in absolute temperature, is a constant quantity, holds good for the saturated alcohols of the fatty series (compare preceding Abstract).

	M.	*t*.	*r*.	$\frac{Mr}{T + t}$.
Ethylic alcohol	46	78·3°	201·42	26·37
Propylic alcohol.................	60	96·96	164·07	26·61
Isopropylic alcohol..............	60	82·19	159·72	26·98
Butylic alcohol	74	116·48	138·18	26·25
Isobutylic alcohol..............	74	107·67	136·16	26·47
Amylic alcohol (fermentation)...	88	130·06	118·15	25·79
Dimethylethylcarbinol..........	88	102·08	110·37	25·90

The boiling points correspond with a pressure of about 750 mm., and the mean value of the constant is 26·34. Schiff's results with ethereal salts of the acetic series give about 21, and for the hydrocarbons of the benzene series about 20. The results of Berthelot and Ogièr with formic and acetic acids give different values, but in these cases the vapour is not normal. If, however, the values for normal vapour are taken, the constant becomes 25·9 for acetic acid. It follows that the value of the constant $\frac{Mr}{T + t}$ remains practically constant for a given series of compounds, although it varies from one series to another. Trouton's empirical law is therefore capable of wide and important

application, and makes it possible to calculate the latent heats of vaporisation of a whole series of compounds, if the value for one of them is known.
C. H. B.

Heat of Combustion of Glycogen. By F. STOHMANN and R. SCHMIDT (*J. pr. Chem.*, 1894, [2], **50**, 385—387).—The glycogen employed was extracted from the liver of a rabbit by means of water, no alkali being used. After purification by precipitation with alcohol in the presence of hydrochloric acid and potassium mercury iodide, it was dried, extracted with ether to remove a small amount of fat, and then again dried at 120°. Ignition was ensured by the addition of a small piece of collodion. The following table shows the results obtained, compared with the corresponding data for cellulose and starch.

	Heat of combustion.	
	Per gm. cal.	Per gm. mol. Cal.
Glycogen........	4190·6	678·9
Cellulose........	4185·4	678·0
Starch..........	4182·5	677·5

The heat of formation of glycogen is therefore 230·1 Cal.
A. H.

Thermochemistry of the Isomeric Acids of the Composition $C_7H_6O_3$ and $C_8H_8O_3$. By F. STOHMANN and H. LANGBEIN (*J. pr. Chem.*, 1894, [2], **50**, 388—400).—The following table contains the heats of combustion and formation of a number of these acids, compared with their electrical conductivity, as determined by Ostwald and others.

	Heat of combustion. Cal.	Heat of formation. Cal.	Electrical conductivity. *k*.
Hydroxybenzoic acid [ortho] ...	727·1	137·9	0·102
,, ,, [meta]....	726·6	138·4	0·0087
,, ,, [para]....	725·9	139·1	0·00286
Hydroxytoluic acid			
[COOH : Me : OH = 1 : 2 : 6]..	883·4	144·6	0·106
,, ,, [1 : 3 : 2]..	879·3	148·7	0·1018
,, ,, [1 : 5 : 2]..	880·1	147·9	0·00841
,, ,, [1 : 4 : 2]..	878·4	149·9	0·0684
Anisic acid [OMe : COOH = 1 : 4]	895·2	132·8	0·0032
Mandelic acid................	890·9	137·1	0·0417
Phenoxyacetic acid............	903·3	124·7	0·0756
Orthohydroxymethylbenzoic acid			
[COOH : CH_2·OH = 1 : 2]....	887·8	142·2	0·015
Phthalide....................	884·7	74·3	—

It appears that both heat of combustion and electrical conductivity are greatest for the ortho-acids and least for the para-acids.

Taking the heat of combustion of benzoic acid as 771·7, and of the toluic acids as 929·4 (ortho), 929·1 (meta), and 927·4 (para), it follows that the substitution of hydroxyl for hydrogen in benzoic acid diminishes the heat of combustion by 44·6 (ortho), 45·1 (meta), and 45·8 (para) Cal., whilst in the toluic acid series the numbers vary from 46—49·8 Cal.

The substitution of methyl for hydrogen, on the other hand, increases the heat of formation by the following amounts.

Benzoic acid, ortho	157·7 Cal.
,, meta	157·4 ,,
,, para	155·7 ,,
Salicylic acid, Me = 6	156·3 ,,
,, Me = 3	152·2 ,,
,, Me = 5	153·0 ,,
,, Me = 4	151·3 ,,

The substitution of methyl for hydrogen, however, gives rise to different results, according as this hydrogen atom is combined with carbon, nitrogen, or oxygen. The same relations hold with the group CH_2·COOH, so that it may be concluded that a carbon atom which combines with a nitrogen atom requires an amount of energy equal to 10—12 Cal., and one which combines with an oxygen atom 15—20 Cal. more than one which combines with another carbon atom. The actual values obtained were

	CH_3.	CH_2·COOH.
With C	156·6 Cal.	150·9 Cal.
,, N	166·6 ,,	162·7 ,,
,, O	171·7 ,,	170·8 ,,

By means of these numbers, the heats of formation of the various acids can be approximately calculated from those of the simpler acids from which they are derived by substitution. A. H.

Mercuric Sulphates. By R. Varet (*Compt. rend.*, 1894, **119**, 684—687).—The heat of dissolution of mercuric sulphate in dilute sulphuric acid is +4·35 Cal. at 16·5°, and +4·90 Cal. at 14°. Measurement of the heat developed by the action of hydrochloric acid on mercuric sulphate, sulphuric acid on mercuric chloride, hydrocyanic acid on mercuric sulphate and sulphuric acid on mercuric cyanide, sulphuric acid and sodium chloride on mercuric sulphate, and other similar reactions give, as a mean value

HgO ppt. + H_2SO_4 dil. = $HgSO_4$ diss. + H_2O liq.	develops +	2·6 Cal.
HgO ppt. + H_2SO_4 liq. anhyd. = $HgSO_4$ sol. + H_2O liq.	,,	+ 19·6 ,,
HgO ppt. + SO_3 solid = $HgSO_4$ solid.	,,	+ 40·1 ,,
Hg liq. + S solid + O_4 gas = $HgSO_4$ solid	,,	+166·1 ,,

The dissolution of basic mercuric sulphate in dilute sulphuric acid develops +9·1 Cal., and reactions similar to those employed in the case of the normal sulphate give the following result.

$3HgO$ ppt. + H_2SO_4 dil. = $3HgO,SO_3$ sol. + H_2O liq. .... develops +13·38 Cal.
$HgSO_4$ sol. + $2HgO$ ppt. = $3HgO,SO_3$ solid .... „ +10·78 „

The action of a large quantity of water on normal mercuric sulphate does not result in its complete conversion into the basic sulphate, owing to the simultaneous formation of an acid sulphate, with development of heat. The maximum thermal disturbance corresponds with the formation of a solution containing sulphuric acid, and saturated with the basic sulphate. Sulphuric acid is completely displaced from mercuric sulphate by even very dilute hydrocyanic acid, and is also displaced almost, if not quite, completely by hydrochloric acid. C. H. B.

Relation between the Vapour Pressures of a Substance in the Solid and Liquid State. By A. Ponsot (*Compt. rend.*, 1894, **119**, 791—794).—The author has formerly shown that for ice and water

$$RT \log \frac{F}{f} = E\left[\frac{l_0}{T_0}(T_0 - T) - (C_e - C_g)\,T\left(\frac{T_0 - T}{T} - \log\frac{T_0}{T}\right)\right].$$

F and f being the vapour tensions at T, l_0 the latent heat of fusion at T_0, the temperature of the triple point, C_e and C_g the specific heats of water and of ice. This relationship is now shown to hold good in the cases of benzene and acetic acid. H. C.

The Absorption Coefficients of Carbonic Anhydride and Hydrogen Sulphide in Water at the Freezing Point. By K. Prytz and H. Holst (*Ann. Phys. Chem.*, 1894, [2], **54**, 130—138).—If a current of gas be passed through pounded ice, the temperature sinks to that of the freezing point of a saturated aqueous solution of the gas, which may be calculated by the usual formulæ. For carbonic anhydride and hydrogen sulphide, the authors find the depressions to be respectively 0·156° and 0·392°, the calculated numbers being 0·158 and 0·377. The absorption coefficients were then determined, both at zero and at the freezing point of the solution. The method consisted in passing a stream of the gas through (or addition of solid carbonic anhydride to) the water contained in a flask; finding the quantity of gas contained by weighings, and correcting for that above the liquid by measurement of manometric pressure. Corrections are made for small quantities of foreign gases unavoidably present. For carbonic anhydride at 0°, they obtained the value 1·7308, and at −0·15° 1·7375, whilst hydrogen sulphide gave the value α_0 = 4·6796. Bunsen found a value a_0 = 1·7967 for the former gas, but this was obtained by extrapolation, the lowest observed temperature being 4·4°. Henrich obtained the value 1·7326 (Abstr., 1892, 1044). The value 4·6796 also is considerably higher than that found by Schönfeld and Carius for the same gas; this the authors consider is due to the fact that these observers did not use completely saturated solutions.

L. M. J.

New Reaction Illustrating the Phenomenon of Dissociation. By A. Gunn (*Chem. News*, 1894, **70**, 223—224).—When ammonia (sp. gr. 0·880) is added, drop by drop, to a solution containing 0·2 gram of zinc sulphate in 5 c.c. of water, until it is 1 or 2 drops in excess of the quantity required to re-dissolve the precipitate, and 10 or 12 drops of a 10 per cent. solution of sodium phosphate and 5 c.c. of water are also added, a perfectly bright solution is obtained, which on heating acquires a turbidity that increases to a thick curdy precipitate in the boiling liquid; the mixture, however, regains its original brightness and freedom from any precipitate on cooling. The operation may be repeated many times if loss of ammonia is avoided. When the excess of ammonia is removed by drawing air through the cold solution, a precipitate is obtained which contains ammonia; whereas the precipitate obtained from the boiling solution does not contain ammonia; hence the formation of the precipitate in the latter case appears to be due to dissociation. D. A. L.

Experimental Proof of the Laws of Van't Hoff, Arrhenius, and Ostwald for Dilute Solutions. By M. Wildermann (*Zeit. physikal. Chem.*, 1894, **15**, 337—357).—The freezing points of very dilute solutions have been determined with great care and every precaution to secure the highest attainable degree of accuracy. Experiments with the non-electrolytes cane-sugar, carbamide and alcohol show that these in the most dilute solutions give results in perfect accordance with van't Hoff's well known formula for the molecular reduction $0·02\ T^2/w$, if for w the value 80 Cal. is taken. The electrolytes, sulphuric acid, potassium chloride, di- and tri-chloracetic acid, and orthonitrobenzoic acid all give reductions of the freezing point of water which are in accordance with the view that these substances have undergone electrolytic dissociation to the degree indicated by the conductivity measurements of the corresponding solutions. The dissociation calculated from the freezing points is, however, somewhat smaller than that calculated from the conductivities, which may in part be accounted for by the presence of higher non-dissociated and dissociated molecules in the solution (comp. Abstr., 1893, ii, 509). The accuracy attained in these experiments is sufficient to enable calculations to be made of the affinity coefficients from Ostwald's law of dilution in the cases of dichloracetic acid and orthonitrobenzoic acid. The calculated value is practically independent of the dilution in each case, but is somewhat smaller than that obtained from the conductivity. H. C.

Determination of the Freezing Point of Water. By M. Wildermann (*Zeit. physikal. Chem.*, 1894, **15**, 358—364).—In determining the freezing point of water or of very dilute aqueous solutions, an error is introduced, owing to the fact that from such solutions the ice separates out in fine crystals which cake round the bulb of the thermometer, this occurring before the thermometer indicates the temperature of the solution. The layer of ice being a bad conductor, an error is introduced of 0·0015—0·0017° in the temperature registered as the freezing point. To obviate this, the author allows the solution under examination to partially solidify before the thermometer, which has been previously cooled below the melting point to be observed, is introduced. The ice does not crystallise out round the bulb under these circumstances, and the mercury rises to the true melting point.

H. C.

Freezing of Sulphuric acid Solutions. By R. Pictet (*Compt. rend.*, 1894, **119**, 642—645).—Four series of experiments were made with mixtures containing increasing proportions of either water or sulphuric acid. The results of all the series were found to agree, provided that congelation was allowed to take place very slowly and the temperature of the cold chamber was kept as high as was consistent with the freezing of the liquid; if these precautions are not observed, the results are not concordant. The curve of the temperatures of crystallisation cuts the zero line five times, but the points of maxima and minima do not correspond with definite hydrates except in the case of the decahydrate $H_2SO_4,10H_2O$, which freezes at −88°. The liquid contains more sulphuric acid than the crystals when the freezing point falls on a descending part of the curve, but the reverse is the case when it falls on an ascending part of the curve. Whilst at the points of maxima and minima the liquid and the crystals have the same composition. The results are given in the following table.

Formula.	Percentage of sulphuric acid.	Sp. gr.	Freezing point.
H_2SO_4	100·00	1·842	+10·5°
$H_2SO_4 + H_2O$	84·48	1·777	+ 3·5
$H_2SO_4 + 2H_2O$	73·08	1·650	−70
$H_2SO_4 + 4H_2O$	57·65	1·476	−40
$H_2SO_4 + 6H_2O$	47·57	1·376	−50
$H_2SO_4 + 8H_2O$	40·50	1·311	−65
$H_2SO_4 + 10H_2O$	35·25	1·268	−88
$H_2SO_4 + 11H_2O$	33·11	1·249	−75
$H_2SO_4 + 12H_2O$	31·21	1·233	−55
$H_2SO_4 + 13H_2O$	29·52	1·219	−45
$H_2SO_4 + 14H_2O$	28·00	1·207	−40
$H_2SO_4 + 15H_2O$	26·63	1·196	−34
$H_2SO_4 + 16H_2O$	25·39	1·187	−26·5
$H_2SO_4 + 18H_2O$	23·22	1·170	−19
$H_2SO_4 + 20H_2O$	21·40	1·157	−17
$H_2SO_4 + 25H_2O$	17·88	1·129	− 8·5
$H_2SO_4 + 50H_2O$	9·82	1·067	− 3·5
$H_2SO_4 + 75H_2O$	6·77	1·045	0·00
$H_2SO_4 + 100H_2O$	5·16	1·032	+ 2·5
$H_2SO_4 + 300H_2O$	1·78	1·007	+ 4·5
$H_2SO_4 + 1000H_2O$	0·54	1·001	+ 0·5

C. H. B.

Pressure of Solution as a Means of Determining the Temperature of Change. By J. Verschaffelt (*Zeit. physikal. Chem.*, 1894, **15**, 437—456).—From the analogy between the process of vaporisation and that of solution, Nernst concludes that substances have a certain solution pressure analogous to their vapour pressure.

Since in many cases a change in the composition of a substance, as for example in a salt containing water of crystallisation, is indicated by an abrupt change in the vapour pressure, a change in composition should also be indicated by a change in the pressure of solution. This method is applied to an examination of the decomposition of crystallised sodium sulphate.

$$Na_2SO_4,10H_2O \rightleftarrows Na_2SO_4 + 10H_2O,$$

the behaviour of the salt towards mixtures of amylic alcohol and water at different temperatures being observed. The temperature of change is found to be 32·74°, corresponding with the temperature of maximum solubility.

From the results obtained, the value of Van't Hoff's coefficient i for water dissolved in amylic alcohol is calculated. This calculation points to a complex molecule of at least $(H_2O)_4$. H. C.

Correct Formulæ for Osmotic Pressure; Change of Solubility, Melting and Boiling Points; Heats of Solution and Dilution in Dissolved Dissociated Substances. By J. J. van Laar (*Zeit. physikal. Chem.*, 1894, **15**, 457—497).—Thermodynamical calculations not suitable for abstracting. H. C.

Rate of Hydrolysis of some Ethereal Salts. By R. Löwenherz (*Zeit. physikal. Chem.*, 1894, **15**, 389—398).—A continuation of the work of De Hemptinne (Abstr., 1894, ii, 274), the chief result of whose investigations was that the nature of the alcohol was of little influence, that of the acid of great influence, on the rate of hydrolysis of ethereal salts. In order to study the influence of the alcohol, the acetates of glycerol and phenol were examined. The influence of the acid was studied by taking ethereal salts of formic, mono-, di- and tri-chloracetic, and benzoic acids, and also ethylic iodide. The results fully confirm De Hemptinne's conclusions. The ratio of the constants of the velocity equation in the case of the greatest variation for the alcohols (methylic alcohol and phenol) is only about 2 to 1, but the greatest variation for the acids (formic and benzoic acids) is about 3700 to 1. H. C.

Position of Magnesium in the Genetic System of the Elements; Atomic Volumes; Allotropes and Isomerides. By C. T. Blanshard (*Chem. News*, 1894, **70**, 235, 271—272, 295—296).—It is pointed out that the atomic volume, the analysis of the spectrum, the volume heat (sp. ht. × sp. gr.) suggest the classification of magnesium with calcium, strontium and barium instead of with zinc cadmium and mercury; but the atomic heat, on the other hand, places it between beryllium and zinc.

The author furnishes a table of atomic volumes based on the most recent or best authenticated values for atomic weights and specific gravities. Furthermore, he shows, from tabulated data relating to atomic volumes, specific heats, heats of combustion, boiling points and specific gravities, that the relationship which exists between these properties in the allotropic forms of elements is similar to what it is in isomeric inorganic and organic compounds, which may indicate a similarity in constitution as regards elements and those compounds. D. A. L.

The Chemometer. By W. OSTWALD (*Zeit. physikal. Chem.*, 1894, **15**, 399—408).—To any instrument that would be capable of measuring the chemical intensity of a system, or that would show whether any two systems were in chemical equilibrium, the name "chemometer" may be given. The author discusses generally the conditions which such an instrument would have to fulfil, and points out that for electrolytes the electrometer may be considered as a chemometer, as chemical intensity and E.M.F. are proportional to one another.

H. C.

Preservation of Chemically Pure Alkaline Solutions. By A. v. KALECSINSZKY (*Zeit. anorg. Chem.*, 1894, **7**, 384—385).—The author employs a glass bottle having a removable metallic bottom, and thin beakers of platinum or silver, of such a size that they just fit into the glass bottle. The alkaline solution comes into contact only with the metallic beaker. The flask is closed with a rubber cork and fitted with tubes as in the case of an ordinary wash bottle, the longer tube is, however, made of platinum or silver. E. C. R.

Inorganic Chemistry.

Combination of Hydrogen Fluoride with Water. By R. METZNER (*Compt. rend.*, 1894, **119**, 682—684).—Neither anhydrous hydrogen fluoride nor a mixture containing 30 per cent. of water solidifies at −70°, but at about −45° the "pure" acid of commerce, which contains about 43·4 per cent. of hydrogen fluoride, gradually deposits small, hard, opaline masses. If some of this solid mass is placed in acid containing 70 per cent. of the fluoride and cooled to −70°, it sinks and rapidly dissolves. When an acid containing 55 per cent. is slowly cooled to about −45°, it is converted into small, truncated prisms which have the composition HF,H_2O, and melt at −35°, the temperature remaining constant until the change is complete. The crystals fume in the air, dissolve readily in the cold concentrated acid, and are heavier than it and than the commercial acid, which has a sp. gr. of 1·15. Since the sp. gr. of the anhydrous acid is 0·988, it follows that mixtures of the acid and water show a point of maximum contraction, which probably corresponds with the monhydrate. The monhydrate readily forms supersaturated solutions. There is no evidence of the existence of a hydrate $HF,2H_2O$, although the acid that distils without change approximates to it in composition. This acid solidifies when strongly cooled, but the crystals have no definite melting point and seem to be a mixture of the monhydrate and ice. C. H. B.

Formation of Ozone by the Action of Electric Oscillations. By E. WIEDEMANN and G. C. SCHMIDT (*Ann. Phys. Chem.*, 1894, [2], **53**, 924—927).—The authors show that if, in the preparation of ozone by the influence of the silent discharge, means are adopted to obtain oscillations of a regular periodic nature, the yield of ozone is increased. They, however, only worked at low pressures where the yield of ozone was small, namely, 0·12 per cent., under the most favourable conditions. L. M. J.

Gases from Wood Charcoal at a High Temperature. By DOSMOND (*Compt. rend.*, 1894, **119**, 733—735).—When wood charcoal is heated to redness out of contact with air, it gives off from 170 to 250 litres of gas per kilo. The gas has the mean composition CO_2, 9·14; O, 0·26; CO, 18·08; H, 49·11; CH_4, 16·04; N, 7·37 = 100·00, and its antiseptic properties are superior to those of carbonic oxide. The greater part of the gas is probably formed by the pyrogenic decomposition of solid or liquid carbon compounds condensed in the charcoal. It would seem that in cases of poisoning by so-called charcoal fumes, the carbonic oxide is not simply a result of incomplete combustion. C. H. B.

Influence of certain Metals on the Stability of Ammonium Amalgam. By G. MICHAUD (*Amer. Chem. J.*, 1894, **16**, 488—490).—Having examined the behaviour of a saturated solution of ammonium chloride with mixtures of sodium amalgam and amalgams of silver, aluminium, gold, bismuth, cadmium, cobalt, copper, iron, magnesium, manganese, lead, platinum, antimony, tin, and zinc respectively, the author arrives at the following conclusions:—(i.) That when the radicle ammonium is set free in presence of an alloy of mercury with one of the aforesaid metals, its stability is inferior to what it would be when associated with mercury alone. (ii.) That a very small percentage of platinum absolutely prevents the formation of the ammonium amalgam. (iii.) That the power of decreasing the stability of the radicle ammonium is greater in the electro-negative metals, but is not proportional to their polarity. (iv.) That in spite of the contrary conclusion of several chemists (compare Landolt, *Zeit. f. Chem.*, 1869, **12**, 429), the amalgam of ammonium does contain ammonium, for whenever a simple mixture of hydrogen and ammonia is evolved during the experiment, it has not the power to dilate the mercury and to give it the characteristic appearance of the amalgam of ammonium. G. T. M.

Ammonium Orthophosphate. By K. KRAUT (*Zeit. anorg. Chem.*, 1894, **7**, 392).—In reference to Schottländer's remarks (this vol., ii, 64), the author points out that he had already shown in 1855 that the sparingly soluble crystals sometimes obtained on adding ammonium phosphate solution to ammoniacal liquids, have the composition $PO_4(NH_4)_3,3H_2O$. E. C. R.

Presence of Ammonia in Zinc Powder. By F. ROBINEAU and G. ROLLIN (*Zeit. anal. Chem.*, **33**, 594; from *Moniteur scientifique*, [4], **7**, 138).—Zinc powder contains ammonia, partly in a form soluble in hot water, partly also in combination, from which it is set free by boiling with soda. It can be entirely freed from ammonia by boiling and washing with dilute sulphuric acid (1—100), but, after drying in purified air, ammonia can again be detected in it.

M. J. S.

Conversion of Black Mercury Sulphide into the Red Modification and the Density and Specific Heat of the two Modifications. By W. Spring (*Zeit. anorg. Chem.*, 1894, **7**, 371—383).—The ordinary black mercury sulphide cannot be converted into the red modification by pressure. Theoretically, it would require a pressure of 35,000 atmospheres. The author has obtained a new black modification of mercury sulphide by subliming ordinary mercury sulphide in the presence of a sufficient quantity of an inert gas. It is a micro-crystalline powder, is converted into the red modification by treatment with yellow ammonium sulphide, and has sp. gr. = 8·0395 at 17°. When subjected to a pressure of 100 atmospheres, it is easily converted into the red modification.

The red sulphide, when heated at 250—320°, turns black, but regains its red colour on cooling, whether it be cooled slowly or quickly. After being heated at 410°, it, however, remains black on cooling.

The sp. gr. of the ordinary black modification varies from 7·6242 at 18·3° to 7·5610 at 77·8°. The sp. gr. of the red modification, obtained by treating the black modification with ammonium sulphide, varies from 8·1289 at 21·6° to 8·0902 at 77·7°. The sp. gr. of the red modification, obtained by sublimation, varies from 8·1587 at 15·8° to 8·0978 at 77·7°. If the numbers obtained between these temperatures are represented graphically, parallel curves are obtained, showing that the volume for all the modifications varies in the same manner. Similar parallel curves are obtained by representing graphically the specific heats of the three modifications at different temperatures. The specific heat of the black sulphide varies from 0·0835 at 25—30° to 0·1433 at 75—80°; that of the red sulphide from 0·0749 at 25—30° to 0·1270 at 75—80°.

E. C. R.

Temperatures of Transformation of Irons and Steels. By G. Charpy (*Compt. rend.*, 1894, **119**, 735—737).—The metals were heated in a small furnace, the source of heat being a platinum wire, through which an electric current was passed, and the temperatures were

	a_1.		a_2.		a_3.	
Steel containing	Heating.	Cooling.	Heating.	Cooling.	Heating.	Cooling.
Carbon 0·07 per cent...	—	—	740°	730°	865°	840°
,, 0·09 ,, ..	722°	664°	744	731	903	860
Carbon 0·07 per cent., nickel 1·15 per cent. .	710	698	744	732	835	—
Carbon 0·08 per cent., chromium 0·75 per cent.	—	675	744	744	860	789
Carbon 0·11 per cent., tungsten 0·60 per cent.	—	630	749	740	923	877

automatically recorded by a Le Chatelier pyrometer. The table on p. 110 gives the critical temperatures observed during heating and cooling, the critical points being distinguished by the letters a_1, a_2, a_3 used by Osmond.

With these very soft steels, the point a_1, which is usually more marked the higher the proportion of carbon, is only feebly indicated, and the point a_3 varies greatly both with the nature of the metal and the rate of heating. The point a_2, on the other hand, is very constant, and seems to indicate a distinctly reversible change, since it is produced at the same temperature during both heating and cooling. Arnold has also observed this constancy of the point a_2 in soft steels.

Mechanical tests made after tempering indicate that the rectilinear break in the curve of extension disappears when the metal has been heated to 750—880° and then tempered. When the same steels are heated, after having been drawn in the cold, the curves, as a rule, are identical with those given by the annealed metal, and this is true also of the tempered metals, which indicates that the changes produced by tempering or hardening are not permanent in the cold, and disappear on annealing at a temperature below the temperature of transformation. By rapid heating, however, curves were obtained in which the point 740° did not exist or was replaced by a convexity extending from 720° to 740°.

The facts observed show that the point a_1 (690—700°) corresponds with the transformation of the carbon estimated by Eggertz's method, a transformation which markedly increases the hardness of the steel; the point a_2 (740°) corresponds with the transformation of iron which is characterised by the rectilinear break in the curve of extension, and which slightly modifies the magnetic and mechanical properties; the point a_3 (860°) corresponds with a second transformation of the iron which seems to affect more particularly the magnetic properties.

C. H. B.

Action of Ferric Acetate on Potassium Iodide and Hydrogen Iodide. By K. SEUBERT and R. ROHRER (*Zeit. anorg. Chem.*, 1894, **7**, 393—405; see also this vol., ii, 17).—Ferric acetate and potassium iodide do not react with liberation of iodine, either in neutral solution or in the presence of a large excess of acetic acid. If, however, hydrochloric or sulphuric acid is added to the mixture, iodine is set free, and when the ratio of acid to the ferric acetate is 3 equivalents to 1 equivalent, the quantity of iodine liberated is equal to that liberated by an equivalent quantity of ferric chloride or sulphate.

Ferric acetate liberates iodine from hydrogen iodide, but when the proportions employed are 1 mol. hydrogen iodide and 1 equivalent of ferric acetate, the quantity of iodine liberated is considerably less than in the case of ferric chloride and ferric sulphate. When 10 mols. of hydrogen iodide are employed for 1 equivalent of ferric salt, 99 per cent. of the theoretical amount of iodine is liberated in all three cases. The addition of hydrochloric or sulphuric acid to the mixture $Fe(C_2H_3O_2)_3 : HI$, increases the amount of iodine liberated until it nearly approaches the amount liberated in the case of ferric chloride and sulphate.

E. C. R.

Methods of Removing the Phosphoric acid as Alkali Phosphate from Phosphates of Calcium and Iron. By E. A. Schneider (*Zeit. anorg. Chem.*, 1894, **7**, 386—391).—The hydrogel obtained by dialysing a solution of ferric chloride saturated with normal calcium orthophosphate contains ferric oxide and phosphoric anhydride in the proportion 55·29 : 44·71 (Abstr., 1893, ii, 573). When the solution of this hydrogel in ammonia is dialysed, ammonium phosphate is removed; after 13 days the ratio was 82·37 Fe_2O_3 : 17·63 P_2O_5. After another 15 days, the phosphoric anhydride amounted to 11·07 per cent., and after another 19 days, the phosphoric anhydride amounted to 9·17 per cent. The slowness of the removal of phosphoric anhydride after the first 13 days is probably due to the reformation of ferric phosphate from the double compound of ferric phosphate and ammonium phosphate which is probably present in the solution.

When the hydrogel is treated with potassium hydroxide, it is almost quantitatively converted into potassium phosphate and ferric hydroxide. When treated with potassium carbonate, a double compound is formed, soluble in water, which, when allowed to remain in solution, deposits a precipitate. When this precipitate is subjected to dialysis, it contains phosphoric anhydride and ferric oxide in the proportion 15·10 : 84·90.

A solution of ferric phosphate in ferric sulphate, prepared by digesting normal calcium orthophosphate with a solution of ferric sulphate, and containing 130·8 grams P_2O_5, 183·54 grams Fe_2O_3, and 238·62 grams SO_3 per 1000 c.c., was diluted three successive times with water; the precipitates so produced contained phosphoric anhydride and ferric oxide in the proportion 1 : 1·36. 5 c.c. of the above solution, after dilution with 900 c.c. of water, contained 3·22 per cent. of the P_2O_5 originally present, 8·72 per cent. of the Fe_2O_3, and 92·62 per cent. of the SO_3.

The author points out the application of the above results to the manufacture of soluble phosphates from natural phosphates and Thomas slag. E. C. R.

Complex Inorganic Acids: Phosphoduodecimolybdic acid and Phospholuteomolybdic acid. By F. Kehrmann and E. Böhm (*Zeit. anorg. Chem.*, 1894, **7**, 406—426).—Phosphoduodecimolybdic acid is obtained by adding a cold solution of ammonium molybdate to a cold solution of sodium phosphate and nitric acid; the precipitate thus obtained is dissolved in nitrohydrochloric acid and reprecipitated with water; finally, it is crystallised from water containing a few drops of nitric acid. It crystallises in beautiful orange octahedra, and contains by analysis phosphoric anhydride and molybdic anhydride in the proportion 1 : 23·89. The *barium salt*, $3BaO,P_2O_5,24MO_3$, obtained by adding barium chloride to a concentrated solution of the acid, crystallises in bright yellow octahedra, resembling the barium salt of the corresponding tungstic compound.

Phospholuteomolybdic acid.—The *ammonium salt*,

$$3(NH_4)_2O,P_2O_5,18MO_3 + 14H_2O,$$

of this acid is obtained by precipitating with ammonium chloride the mother liquors of the barium salt of the duodeci-acid, after separating the barium therefrom with dilute sulphuric acid. It crystallises in orange-red prisms, is stable in aqueous solution at the ordinary temperature, but decomposes when heated with formation of ammonium phosphoduodecimolybdate. The *potassium salt* is obtained by adding potassium chloride to the mother liquors of the ammonium salt. It is more easily obtained by adding potassium chloride to a mixture of the duodeci-acid and phosphoric acid which has been allowed to remain for some time. It is more stable than the ammonium salt, and crystallises from boiling water without decomposition in short, orange-red prisms containing $14H_2O$. The *free acid*, $3H_2O,P_2O_5,18MO_3$ + Aq, is obtained by adding strong alcohol to a concentrated solution of the potassium salt acidified with sulphuric acid, then adding ether, and allowing the mixture to remain in a freezing mixture until the potassium sulphate has separated. It crystallises in long, transparent, orange-red prisms, which absorb water from the air, and effloresce when allowed to remain over sulphuric acid. When the aqueous solution is treated with potassium chloride, a quantitative yield of the potassium salt is obtained.

Phosphoduodecimolybdic acid is obtained directly by adding yellow molybdic anhydride to a boiling aqueous solution of phosphoric acid. The authors attempted to prepare the corresponding arsenic compound in the same way, but the compound obtained was arsenoluteomolybdic acid. When a solution of ammonium molybdate containing nitric acid is mixed with arsenic acid in sufficient quantity for the formation of the 24-acid, a yellow precipitate of ammonium arsenoduodecimolybdate is formed. By boiling this precipitate with nitrohydrochloric acid, the luteo-acid and molybdic acid are obtained. The *ammonium salt*, $3(NH_4)_2O,As_2O_5,18MO_3 + 14H_2O$, crystallises in beautiful, orange-red prisms, and is very soluble both in water and alcohol. The *potassium salt*, $3K_2O,As_2O_5,18MO_3 + 14H_2O$, is very similar to potassium phospholuteomolybdate, and is insoluble in alcohol.

A cold, concentrated, aqueous solution of the salt,

$$3K_2O,P_2O_5,18MO_3 + 14H_2O,$$

when treated with potassium hydrogen carbonate is converted into the salt, $5K_2O,P_2O_5,17MO_3$ (Abstr., 1894, ii, 384). The latter forms bright, lemon-yellow crystals, decomposes slowly at ordinary temperatures, and at once on boiling. The salt,

$$5(NH_4)_2O,P_2O_5,17MO_3,$$

was obtained in a similar manner in bright-yellow nodules, but owing to its instability cannot be obtained pure.

The authors give a lengthy table showing the reaction of the duodeci- and luteo-acids towards solutions of metallic salts and organic bases. E. C. R.

Mixed Double Haloïds of Antimony and Potassium. By C. H. HERTY (*Amer. Chem. J.*, 1894, **16**, 490—499).—The compounds

$SbCl_3Br_3K_3,1\frac{1}{2}H_2O$, $2SbCl_3,Br_3K_3,2H_2O$, and $SbCl_3BrK,H_2O$, obtained by Atkinson (this Journal, 1883, 289), are in all probability not true salts, but isomorphous mixtures of the double chloride and double bromide. This view is in harmony with the observation that, after heating the supposed substance, $SbCl_3,Br_3K_3,1\frac{1}{2}H_2O$, until a constant weight is obtained, the residue contains an appreciable quantity of antimony, and that therefore the determination of the halogens in it by Atkinson (*loc. cit.*) affords no satisfactory evidence of the nature of the substance.

The analytical results obtained by the author point to the formulæ, $10SbCl_3,23KCl$ and $10SbBr_3,23KBr$ for the double chloride and bromide respectively, and negative the simpler formulæ, $SbCl_3,3KCl$ and $SbBr_3,3KBr$, assigned to these compounds by Poggiale (*Compt. rend.*, 1845, **20**, 1180). G. T. M.

Antimony Vermilion. By H. Baubigny (*Compt. rend.*, 1894, **119**, 687—690).—Antimony sulphide precipitated from solutions of the chloride by sodium thiosulphate always contains more or less antimony oxychloride, even when precipitation takes place in a strongly acid solution. The proportion of oxychloride is lower the higher the proportion of acid, and the higher the temperature at which precipitation takes place.

The precipitate obtained by the action of the thiosulphate on solutions of tartar emetic containing tartaric acid under the conditions described by Wagner, although cinnabar-red in colour, is practically pure antimony trisulphide, Sb_2S_3, whether precipitation takes place at 80° or at the ordinary temperature. When the dried precipitate is treated with carbon bisulphide, very little sulphur dissolves, and the precipitate is practically insoluble in tartaric acid.

C. H. B.

Atomic Weight of Bismuth. By R. Schneider (*J. pr. Chem.*, 1894, [2], **50**, 461—471).—The author, in his earliest determinations (*Ann. Phys. Chem.*, 1851, **82**, 303), found that the atomic weight of bismuth is 208 ($O = 16$), and this number was confirmed by Marignac in 1883. More recently Classen (Abstr., 1890, 706) has found it to be 208·9, the same method being employed as was originally used by the author. In view of this discrepancy, the experiments have been repeated with carefully purified material.

Six experiments, in which an aggregate of more than 43 grams of metal were converted into the oxide, gave as a mean result 208·05 ($O = 16$), the separate numbers varying from 207·84 to 208·15. The presence of lead in the metal used, to which Classen ascribed the difference between his results and the author's, would tend to raise the number obtained, as would also any loss of bismuth during the evaporation of the solution of the metal in nitric acid and the subsequent ignition of the nitrate.

The author suggests the conversion of bismuth iodide into the oxide by ignition with mercuric oxide, or into the sulphide by treatment with mercuric sulphide, as independent methods by which further results might be obtained, but has not yet completed his experiments in these directions. A. H.

Mineralogical Chemistry.

Origin of Bitumens. By S. F. PECKHAM (*Amer. J. Sci.*, 1895, [3], **48**, 389—395).—This paper is a retrospect of the discussion of the origin of petroleum during the 30 years that have elapsed since the author first directed his attention to the subject. The chemical theories are passed by without further notice, and the organic origin of bitumen is accepted as practically undisputed. The question to be decided is whether bitumens are distillates or whether they are indigenous in the rock formations in which they are found. The author now brings forward further evidence in support of the view he enunciated 12 years ago, that the derivation of petroleum has not been uniform. The petroleums of Ventura Co., California, he considers, were formed by distillation caused by the metamorphic action which has converted into gneiss the sandstones and shales that flank the low mountains of that region. B. H. B.

Boleite, Cumengeite, and Percylite. By E. MALLARD (*Jahrb. f. Min.*, 1895, i, Ref. 9—10; from *Bull. soc. fran. min.*, 1893, **16**, 184—195).—Tetragonal pyramids of boleite have been prepared artificially by Friedel. Their composition is $PbCl_2,CuO,H_2O$, and in form they are exactly similar to the octahedral crystals previously described. The octahedral and cubic crystals originally investigated differ in composition, and the identity of the octahedral crystals with percylite appears doubtful. The author, therefore, suggests the name of *cumengeite* for the latter crystals, and regards the birefractive portion of boleite as percylite. B. H. B.

Composition of Polybasite. By G. BODLÄNDER (*Jahrb. f. Min.*, 1895, i, Mem. 98—100).—The author has analysed a specimen of polybasite from Quespisiza, in Chili, with the following results.

Ag.	Cu.	Pb.	As.	Sb.	S.	Total.
67·95	6·07	0·76	3·88	5·15	16·37	100·18

These results do not accord with the formula generally accepted, $9R_2S,Sb_2S_3$, the ratio being 7·74 instead of 9. B. H. B.

Aphthalose from Vesuvius. By P. FRANCO (*Jahrb. f. Min.*, 1895, i, Ref. 26; from *Giornale di mineralogia*, 1893, **4**, 151—155).—The crystalline form of the alkali sulphate from Vesuvius was not investigated by A. Scacchi on natural crystals. The salt crusts were dissolved and recrystallised, rhombic potassium sulphate being first obtained, then rhombohedral aphthalose, $(K,Na)_2SO_4$, and, lastly, rhombic sodium sulphate. The author has examined natural crystals from Vesuvius, and gives the results of his crystallographic measurements. B. H. B.

Actinolite from Ouro Preto, Brazil. By J. A. DA COSTA-SENA (*Jahrb. f. Min.*, 1895, i, Ref. 20; from *Bull. soc. fran. min.*, 1893, **16**, 206—208).—The actinolite occurring in talc schist near Ouro Preto, Brazil, exhibits the usual characteristics of that mineral. Its composition is as follows.

SiO_2.	MgO.	CaO.	Na_2O.	Al_2O_3.	FeO.	MnO.	Loss on ignition.	Total.	Sp. gr.
56·06	27·35	8·26	0·61	2·34	2·71	1·17	2·33	100·83	2·98

B. H. B.

Asbestos and some Associated Minerals. By J. T. DONALD (*Jahrb. f. Min.*, 1895, i, Ref. 21; from *Canadian Rec. Sci.*, **4**, 100—104).—The Canadian asbestos, a fibrous variety of serpentine, containing on an average 13·49 per cent. of water, occurs both in very soft and flexible portions and in hard and brittle ones. This difference appears to be due to the proportion of water, the former containing 14·05 per cent., and the latter only 12·62 per cent. In the Thetford mines, with serpentine there occur veins of a soft, white mineral (analysis I), which hardens on exposure to the air. A white, soft silicate from the serpentine of Lachute was also analysed (II) by the author.

	SiO_2.	Al_2O_3.	FeO.	CaO.	MgO.	H_2O.	CO_2.	Total.
I.	43·19	1·46	0·29	—	41·52	14·00	—	100·46
II.	61·58	—	—	4·04	25·98	6·60	1·29	99·49

In addition to these, magnetite, chrome iron ore, mica, and enstatite occur in association with asbestos. B. H. B.

Scolecite from a Canadian Locality. By J. T. DONALD (*Jahrb. f. Min.*, 1895, i, Ref. 25; from *Canadian Rec. Sci.*, **4**, 99—100).—Scolecite has been found in one of the granitic veins that traverse the serpentine of the Black Lake, Quebec. It occurs in transparent, acicular crystals with vitreous lustre, or in grey, white, or colourless radiated masses. On analysis it yielded

SiO_2.	Al_2O_3.	CaO.	H_2O.	Total.
46·24	26·03	14·09	13·88	100·24

B. H. B.

Antholite from Elzivir, Colorado. By A. P. COLEMAN (*Amer. J. Sci.*, 1895, [3], **48**, 281—283).—An asbestiform mineral occurring in large masses in the township of Elzivir has been analysed by the author. The mineral consists chiefly of irregular bundles of a strong fibrous mineral mixed with a dull green one. The latter, which resembles serpentine, has evidently been formed from enstatite, since it encloses remnants of that mineral. The results of the analyses of the fibrous mineral correspond with the composition of enstatite, supposing its constituents to be rearranged and hydrated. The correspondence is closest with some of the fibrous forms of monoclinic amphibole (antholite or kupferite). B. H. B.

Chocolate Nickel Ores of New Caledonia. By T. MOORE (*Chem. News*, 1894, **70**, 279—280).—These ores, for the most part, are of no definite composition, and consist of a heterogeneous mass of various minerals, such as quartz, chromite, iron oxide, garnierite, steatite, and green nickel silicate; they are red, orange, yellow and brown, and yield, with dilute acids, a yellow iron solution containing only a little nickel, leaving a green residue. The hardness is below 1, they crumble between the fingers, and on exposure to the atmosphere fall to powder, or crack and fissure with rapidity. Before the blow-pipe, water is given off, the colour darkens, and there is either only very slight fusion at thin edges or no fusion at all.

The following analyses start with the deep chocolate-brown (1) and passing through the various shades end (6) with the ochre-yellow ore.

	SiO_2.	Chromite.	Fe_2O_3.	Al_2O_3.	NiO.	MgO.	CaO.	MnO.	H_2O.
1.	33·70	1·20	19·09	1·40	31·28	3·22	0·63	0·20	9·21
2.	37·05	1·21	16·92	0·63	17·36	16·03	0·48	—	10·51
3.	24·25	0·25	42·50	—	24·58	—	0·12	0·17	8·48
4.	34·55	0·20	10·10	0·21	41·31	2·23	0·22	0·23	8·64
5.	48·25	0·62	18·40	0·10	24·67	—	0·48	—	7·33
6.	26·18	4·11	25·17	—	27·61	6·47	0·18	0·23	8·64

Metallurgically the low percentage of magnesia is a great advantage.

D. A. L.

Mineralogical and Chemical Composition of the Sand of the Dunes of Holland. By J. W. RETGERS (*Jahrb. f. Min.*, 1895, i, Mem. 16—74).—In this lengthy memoir, the author gives the results of his investigation of the sand of the dunes of the west coast of Holland. The minerals detected by him in this sand are the following: *Principal constituents*, quartz, garnet, augite, hornblende, tourmaline, epidote, staurolite, rutile, zircon, magnetite, ilmenite, orthoclase, calcite and apatite; *subordinate constituents*, plagioclase, microcline, cordierite, titanite, sillimanite, olivine, disthene, corundum and spinel. No mica is met with, although it has been found in sea sand. The most important result of this mineralogical investigation is the evidence afforded of the sand having been derived from the archæan crystalline schists of Scandinavia and Finland.

B. H. B.

Serpentine of the Binnenthal. By L. DUPARC and L. MRAZEC (*Jahrb. f. Min.*, 1895, i, Ref. 58—59; from *Bull. soc. fran. min.*, 1893, **16**, 210—217).—The serpentine of the Geissalp in the Binnenthal belongs to the gneiss of the Monte Rosa zone. Analyses yielded—

SiO_2.	$Al_2O_3 + Fe_2O_3$.	MgO.	H_2O.
38 to 40	13 to 15	32 to 34	10 to 12.

Chromium is never absent, and ferrous oxide is always present in excess of ferric oxide. Under the microscope, the following constituents are detected: hornblende, diallage, diopside, fibrous serpentine, actinolite, chlorite, magnesite, and, more rarely, calcite, talc, and hæmatite. The author gives analyses of six varieties of serpentine from this locality. B. H. B.

The Cherts of Missouri. By E. O. Hovey (*Amer. J. Sci.*, 1895, [3], **48**, 401—409).—The author has examined 38 specimens of chert from Missouri, about half of them being derived from the lower magnesian series, and the rest from the lower carboniferous. The microscopic characteristics of these cherts are fully described, and analysis shows that when not fossiliferous they are almost pure silica. The results of 18 analyses are given. The author's conclusion as to the origin of these cherts is that they are due to chemical precipitation, probably at the time of the deposition of the strata in which they occur or before their consolidation. B. H. B.

The Torda Brine Springs. By J. Nuricsan (*Jahrb. f. Min.*, 1895, i, Ref. 67; from *Földtani Közlöny*, 1893, **23**, 296—298).—The author gives analyses of water from the Roman brine spring (I) and the shaft spring (II) at Torda in Hungary. The former spring is situated north-east of Torda, 358 metres above the sea, in saliferous strata of neogene age. The temperature of the water was 23·5°, that of the air being 21°. Its sp. gr. is 1·0318 at 15°. The latter spring is situated to the north of the town, 349 metres above the sea. The temperature of the water was 23·5°, and its sp. gr. 1·0956 at 15°. One kilo. of water contains in grams—

	I.	II.	or		I.	II.
Na	18·2573	51·9760		NaCl	46·4373	131·8590
Ca	0·0971	0·5258		Na_2SO_4	—	0·4118
Mg	0·0726	0·1917		$CaSO_4$	0·1224	1·7784
Fe	0·0029	0·0038		$CaH_2(CO_3)_2$	0·0648	—
Al	0·0011	0·0038		$CaCl_2$	0·1276	—
Mn	—	trace		$MgCl_2$	0·2850	0·7220
Cl	28·4600	80·5575		$FeH_2(CO_3)_2$	0·0089	0·0089
SO_4	0·0873	1·5400		Al_2O_3	0·0017	0·0064
H_2CO_3	0·0571	0·0429		SiO_2	0·0406	0·0119
SiO_2	0·0406	0·0119		$MgH_2(CO_3)_2$	—	0·0584
	47·0760	134·8534			47·0883	134·8572

B. H. B.

The Kolop Sulphur Spring. By B. v. Lengyel (*Jahrb. f. Min.*, 1895, i, Ref. 66; from *Földtani Közlöny*, 1893, **23**, 293—295).—The *puszta* of Kolop is situated near Tisza Süly, in the great Hungarian plain. The spring rises in a well 14 to 15 metres in depth. In 1 kilo. of water there are contained in grams—

Na.	K.	Ca.	Mg.	Mn.	Fe.	Al_2O_3.	SO_4.
0·9084	0·0488	0·4783	0·2813	0·0052	0·0027	0·0101	1·4199

Cl.	PO_4.	SiO_2.	H_2CO_3.	Li, Sr, I.	Total.
1·6670	0·0019	0·0157	0·7110	traces	5·5503

The total quantity of free and combined carbonic anhydride is 0·7798, of free carbonic anhydride 0·2670, or 134 c.c., and of hydrogen sulphide 0·0322, or 21 c.c. The temperature of the water is 12·8°, and its sp. gr. 1·0047. B. H. B.

Physiological Chemistry.

Respiratory Exchanges. By A. Loewy (*Pflüger's Archiv*, 1894, **58**, 409—428).—The experiments referred to are numerous and were performed on a man. They relate to the differences produced in respiratory exchange by alterations in atmospheric pressure. They show that respiratory metabolism is within very wide limits not dependent on the composition of the air breathed. Increase of pressure to 1400 mm. of mercury, increase of oxygen to twice the normal, diminution of atmospheric pressure, and lessening of the oxygen until the alveolar tension is 40—45 mm. mercury do not alter the amount of gases interchanged, nor alter the respiratory quotient. With low pressures, increase of muscular work increases slightly the alveolar tension of oxygen. These facts are explicable by the compensating action of the circulation and circulating blood. Lessening of the alveolar tension below 40 mm. leads to a lessening of the oxygen taken in, an increase of the carbonic anhydride given out, and a consequent rise of the respiratory quotient.

Certain measurements are also given; the most important of which, deduced from anatomical and physiological considerations, is the capacity of the contents of the bronchial passages: it is given as between 100 and 150 c.c. W. D. H.

New Theory of Respiration. By A. Loewy and N. Zuntz (*Pflüger's Archiv*, 1894, **58**, 511—522).—This is mainly devoted to theoretical considerations in relation to the preceding investigation and those on pp. 121, 122. The diffusion of gases on which respiration depends seems to be influenced in this way; in the blood corpuscles in large quantities, and to a less degree in the serum are non-diffusible feebly acid substances, which contain large quantities of alkali in the form of a compound which is decomposed by carbonic anhydride. One of these substances is hæmoglobin. W. D. H.

Behaviour of the Phosphorus of Caseïn in Peptic Digestion. By E. Salkowski and M. Hahn (*Pflüger's Archiv*, 1894, **59**, 225—250).—This research especially relates to the behaviour of the phosphorus of caseïn in gastric digestion. By far the greater quantity passes into the soluble products of digestion; the remainder is in the insoluble product (paranucleïn); the more favourable the conditions of digestion, the less paranucleïn is obtained. The phosphorus in solution is in the form of a phosphorised albumose; the phosphorus in this is not combined as orthophosphoric acid, but by boiling with water and barium carbonate it easily passes into that condition.

Metaphosphoric acid is also absent. Paranucleïc acid was obtained from the paranucleïn. W. D. H.

Amount and Composition of the Contents of the Stomach and Intestines of Rabbits at different Periods after Feeding. By H. WEISKE (*Landw. Versuchs-Stat.*, 1894, **45**, 229—241).—Five six months old rabbits were fed for some days with oats *ad libitum*, and then for six days with 60 grams of air-dried oats each. At the end of this time the fæces seemed to consist of undigested oats, so that it could be assumed that all remains of former food had disappeared from the digestive organs. When rabbit No. 5 had finished eating on the ninth day (3½ hours after the food was given), it was killed; No. 4 was killed 24 hours after it had finished eating; No. 3, 52 hours; No. 2, 97 hours; and No. 1, 160 hours afterwards. The digestive organs of all the rabbits were at once cut open and their contents separated and at once dried at 100°. The dry matter, proteïds, crude fibre, ether extract, nitrogen free extract, and ash were determined in contents of the stomach and intestines, and in the fæces-balls. The results, which are given in tables, show the gradual decrease of the nutritive constituents by prolonged action of the digestive organs. Comparing the results obtained with No. 1 with those of No. 5, it is seen that the following amounts were digested: Proteïds, 65·5; nitrogen free extract and fat, 72·4; crude fibre, 54·4; and ash, 47·1 per cent.

Comparing the amounts of the different constituents given in the 60 grams of oats with the amounts found in the stomach, the percentage amounts digested will be as follows. In No. 1 the stomach was practically empty.

	Dry matter.	Proteids.	Ether extract.	Crude fibre.	N. free extract.	Ash.
No. 5	16·4	40·7	14·5	—	25·6	—
No. 4	60·1	75·2	83·7	8·9	66·7	25·7
No. 3	56·2	81·4	65·4	—	63·6	23·8
No. 2	59·8	81·4	68·3	8·5	66·7	24·7

In the 3½ hours during which No. 5 was feeding a certain amount, chiefly proteïn, was digested. Most of the food was digested within 24 hours. Crude fibre does not seem to be digested or fermented to any extent, probably owing to the strong acidity of the pancreatic juice. The considerable digestion of fat cannot be explained, as neither the saliva nor the pancreatic juice digest fat as far as it is known, and no steatolytic ferment has been detected in oats.

N. H. J. M.

Assimilation of Lime in the Body during Disease. By v. NORDEN and K. BELGARDT (*Chem. Centr.*, 1894, i, 1005; from *Berl. klin. Woch.*, **31**, 235—238).—In the course of investigations on the loss and gain of mineral matters in the body under various conditions, the following results were obtained. The lime, &c., was determined in the food and in the solid and liquid excreta. In a patient suffering from acute *arthritis deformans* and fed on milk, white bread, and butter, there was a daily gain or retention of 1·28 grams CaO, 0·06 gram MgO, and 1·13 grams P_2O_5. In a second patient, these figures became 0·75, 0·034, and 1·13 respectively. With a patient suffering from rheumatism of the joints, the average of observations extending over a week showed a loss of 0·42 gram CaO, of 0 14 MgO, and a gain of 0·42 gram P_2O_5. L. T. T.

Addition of Calcium Phosphate to Food. By H. WEISKE (*Landw. Versuchs-Stat.*, 1894, **45**, 242—245).—According to the results of Neumann's experiments (*J. Landw.*, 1894, **42**, 33) the addition of certain phosphates to milk for feeding calves was not only without effect in increasing the true weight but even acted injuriously owing to the increased decomposition of nitrogenous matter (compare Graffenberger, Abstr., 1894, ii, 198). There was also no increased digestibility of the milk constituents. In the author's experiments (*ibid.*, 1893, ii, 132), it was shown that the effect, if any, of calcium phosphate, was rather to decrease digestibility. Calcium carbonate had no appreciable effect in Neumann's experiments; in the author's experiments, the addition of carbonate (2·5 grams per day for each rabbit) to hay seemed to diminish the digestion of the nitrogenous matter, but in the case of oats the digestibility seemed to be increased. It was pointed out that calcium carbonate might behave differently according to whether the food with which it was mixed gave an acid or an alkaline ash (*Landw. Jahrb.*, **21**, 791). N. H. J. M.

Alkalinity of the Blood. By C. LEHMANN (*Pflüger's Archiv*, 1894, **58**, 428—461).—The passage of alkaline affinities from the blood corpuscles into the serum under the influence of carbonic anhydride is confirmed; at the same time, chlorine passes into the corpuscles from the serum. By breathing carbonic anhydride, the arterial blood of an animal becomes poorer in alkaline affinities; this is explained by the passage of the alkaline material from the plasma to the tissues and thence to the excretions. The estimation of the alkalinity of the blood by titration, and by its ability to unite chemically with carbonic anhydride, give different results. Titration gives higher results as the addition of acid liberates free alkaline affinities from the corpuscles. The long continued action of carbonic anhydride acts, however, similarly. W. D. H.

Alkalinity of the Blood. By A. LOEWY (*Pflüger's Archiv*, 1894, **58**, 462—507).—A research of similar nature to the foregoing. A large section treats of methods, and shows the variable results obtainable, but in blood rendered lakey the results are higher, more constant, and comparable with one another. The reason is that when the corpuscles are still intact, there is a changing relation between them and the serum. The alkalinity of the serum itself is constant, temperature making no difference. The average of the experiments recorded gives the alkalinity of the blood as 516 milligrams NaHO for 100 c.c. of blood, a higher value than in previous observations. V. Jaksch gives 200 to 300 milligrams. W. D. H.

Alkalinity of Fresh Blood. By A. LOEWY and N. ZUNTZ (*Pflüger's Archiv*, 1894, **58**, 507—510).—Fresh blood, kept ice-cold, was compared, so far as its alkalinity was concerned, with some of the same blood kept at the body temperature, but tested before coagulation set in. The fresh blood has always the higher alkalinity. In order to investigate the action of coagulation, peptone was injected, but the same diminution of alkalinity was noted, although it was not quite so marked as in those specimens which still possessed the power of coagulation. W. D. H.

Estimation of Blood Corpuscles. By T. LACKSCHEWITZ (*Pflüger's Archiv*, 1894, **59**, 61—90). **Answer to the foregoing.** By M. BLEIBTREU (*ibid.*, 91—103; compare Abstr., 1893, ii, 331).—The first of these papers is a further criticism on Bleibtreu's method. The main points are these: on diluting the blood by intravascular infusion of physiological saline solution, the red corpuscles within the organism take up water and swell. The same must occur when, after severe bleeding, the blood is diluted by tissue juice; outside the body, either before or after coagulation, they lose this property.

The answer to this is that the experiments recorded are too few to found an opinion upon, and even these do not support the conclusions cited. W. D. H.

Coagulation of Milk. By D. F. HARRIS (*J. Anat. and Physiol.*, 1894, **29**, 188—200).—The differences between caseïn and caseïnogen, as advanced by Halliburton, are insisted on. The precipitation of the caseïnogen by saturation with magnesium sulphate is not due to the mechanical action of the crystals, as an inert substance like powdered glass has no precipitating effect (compare Ramsden, *Arch. Anat. Physiol.; physiol. Abth.*, 1894, 517). The scum of boiling milk consists very largely of caseïnogen.

To demonstrate the presence of fat in milk, for class purposes, the blackening on adding osmic acid is recommended.

Caseïn can be redissolved, and it again clots with rennet; this can be repeated several times (compare Peters, this vol., ii, 80). The reasons for believing the non-identity of caseïn and caseïnogen are as follows.

1. Decalcified milk will not coagulate with rennet, but will yield a precipitate of a proteïd (caseïnogen) with acid.

2. A substance can be prepared from milk by precipitation by an acid, or by saturation with a neutral salt, which, in the presence of calcic phosphate, will clot with rennet.

3. There is 13 per cent. more of calcium phosphate used up in rennet coagulation than in acid precipitation; this is an indication that these are chemically distinct processes.

4. There are also certain physical differences (cohesion, solubility, &c.) between the precipitate and the clot. W. D. H.

Citric acid and Calcium Phosphate in Milk. By L. VAUDIN (*J. Pharm.*, 1894, [5], **30**, 464—466).—Soxhlet has shown that milk contains citric acid. The author finds that cow's milk contains from 1 to 1·5 grams, mare's milk from 0·6 to 0·8 gram of citric acid per litre. In addition to this, milk also contains calcium phosphate in solution, which separates out when the milk is heated, but may be redissolved if the recooled milk is agitated. Experiments made with pure calcium phosphate and pure citric acid showed that the calcium phosphate is undoubtedly held in solution by the citric acid. The author considers that the citric acid is not present in the food, but is produced in the mammary gland. L. T. T.

Human Blood in Disease. By H. WENDELSTADT and L. BLEIBTREU (*Chem. Centr.*, 1894, ii, 335; from *Zeit. klin. Med.*, **25**, 204—209).—The amount of nitrogen in defibrinated blood is very variable. The highest observed percentage was in a case of Asiatic cholera (3·586 nitrogen = 22·41 grams proteïd). In most cases the amount of proteïd is under 20 grams per 100 c.c.; the lowest observed percentage (9·46) being in a case of cancer. The maximum percentage of nitrogen in the serum was in a case of chronic nephritis (1·336 nitrogen = 8·355 grams proteïd per 100 c.c.); the next highest was in cholera (1·301 nitrogen = 8·33). The variations in the volume of the corpuscles of the blood were even greater (49·1 to 9·52 c.c. in 100 c.c. of blood). W. D. H.

Leucæmic Blood. By M. MATTHES (*Chem. Centr.*, 1894, ii, 335—336; from *Berlin klin. Woch.*, **31**, 531—534).—In order to separate proteoses and peptones from blood, coagulation of the other proteïds should be first effected by means of alcohol; other methods, even Devoto's, tend to the formation of proteoses during the analytical processes. In two cases of leucæmia, deutero-albumose was formed in the serum. The serum also contained nucleo-albumin from the disintegration of corpuscles. There was no true peptone. General metabolism, except for a slight rise in the excretion of uric acid, appeared normal. W. D. H.

Frigotherapy. By R. PICTET (*Compt. rend.*, 1894, **119**, 1016—1019).—The substances called bad conductors of heat, wool, cotton, silk, wood, &c., prevent very completely radiation of obscure heat emitted between −50° and −60°. Between −60° and −80° the same substances become more diathermanous, and below −100° all the calorific radiations pass through these substances, like light traversing glass.

Experiments on dogs exposed to such temperatures, the animal being protected by warm clothing, lend support to these conclusions; the gain of appetite being taken as the chief indication of radiation. In the author's own person, he cured an attack of dyspepsia by similar means, and frigotherapy is suggested for future use in consequence. W. D. H.

Arrow Poisons. By L. LEWIN (*Virchow's Archiv*, 1894, **138**, 283—346).—A continuation of a former paper (Abstr., 1894, ii, 361), in which a large number more of arrow poisons, chiefly from Asia and Australasia, are treated in a similar manner.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Vegetable Principles which Decompose with Liberation of Carbonic Anhydride. By BERTHELOT and G. ANDRÉ (*Compt. rend.*, **119**, 711—714).—The authors have previously shown that leaves contain substances which easily decompose with liberation of carbonic anhydride even in absence of oxygen, and other substances which oxidise readily with liberation of carbonic anhydride in volume considerably smaller than that of the oxygen absorbed (Abstr., 1894, ii, 151).

Leaves dried at 110° were heated at 120—130° with a 12 per cent. aqueous solution of hydrochloric acid in an atmosphere of hydrogen. After some time, liberation of carbonic anhydride began and proceeded continuously for many hours, becoming less abundant but never ceasing altogether. It seems probable that the carbonic anhydride is derived from carbohydrates with a ketonic function, and compounds such as levulinic acid produced by their decomposition. Its production is accompanied by the formation of humic acids. The acid, $C_{18}H_{16}O_7$, contains an excess of hydrogen, and the production of 2 mols. of carbonic anhydride necessary for the formation of this acid would involve the destruction of about 12 times its weight of carbohydrates. When saccharose is heated with hydrochloric acid of the same concentration and under the same conditions, carbonic anhydride is liberated, although in smaller quantity, and furfuraldehyde and humic acids are formed. The behaviour of carbohydrates containing 5 or 6 atoms of carbon, or multiples of these numbers, is under investigation. C. H. B.

Germinating Process in Vicia Sativa. By D. PRIANISCHNIKOW (*Landw. Versuchs-Stat.*, 1894, **45**, 247—288).—The first series of experiments described was made with the object of ascertaining the changes in composition of etiolated plants during growth. The vetch, *Vicia sativa*, was selected, as it had already been quantitatively investigated (v. Gorup-Besanez, *Ber.*, **7** and **10**; E. Schulze, *Zeit. physiol. Chem.*, **17**), and because the seedlings remain healthy for a comparatively long time when kept in the dark. The material for the investigation was obtained by water-culture, the plants being examined at periods of 10, 20, 30, and 40 days after germination. The results of the analyses are given in a table, and the variations in some constituents are shown in curves. The composition of the seeds is also given for comparison. It is concluded that the loss of nitrogen during germination can be accounted for by the solution of a portion of the nitrogenous matter in the water used for softening the seeds. In the decomposition of the proteïds, amido-compounds are chiefly formed, and the slight increase in the amount of phosphotungstic acid precipitate (observed in the 10-day old sprouts) is due to the production of guanidine and the liberation of choline from lecithin. As regards the amides, asparagine is much the most prominent, and contains 60 per cent. of the total nitrogen in solution after precipitation by phosphotungstic acid. The dry matter of the axes is much more nitrogenous than that of the cotyledons, owing chiefly to the accumulation of non-proteïds; they are, however, richer in proteïds as well. Ammonia is only found in very small quantities (0·05, 0·04, and 0·02 per cent., 1st, 2nd, and 3rd periods respectively). In the decomposition of the starch, cane sugar is formed, and perhaps other soluble carbohydrates which do not directly reduce Fehling's solution; a directly reducing sugar occurred only in any quantity in plants of the first period of 10 days. There seems to be no relation between the decomposition of the proteïds and that of the carbohydrates; most of the former disappears in the first 10 days, when the plants are still rich in carbohydrates.

In the next experiments which were made, some seedlings of *Vicia sativa* were kept for 20 days in distilled water, and others for the same period in calcium sulphate solution (1 per cent.). The effect of calcium was to increase the energy of growth, of respiration, and the decomposition of the proteïds, but without any noticeable one-sided effect on the decomposition of the carbohydrates or proteïds, and without altering the general character of the breaking up of the proteïds (compare Bohm and Liebenberg, *Sitzungsber k. Akad. Wiss., Wien*, **71**, 1875, and **84**, 1881; Raumer and Kellermann, *Landw. Versuchs-Stat.*, **25** and **29**).

The last series of experiments was made with the object of comparing the composition of etiolated plants with that of normal green plants. For this purpose, the *Vicia sativa* seeds were sown in unmanured soil, and plants were taken out every three weeks for analysis. The results show that whilst, in the case of etiolated plants, the amount of asparagine increases in relation to that of other amides, it decreases in normal plants, although it remains in flowering plants in sufficient quantity to be separated. Etiolated and green plants resemble each other qualitatively, the differences are mainly quantitative (compare E. Schulze and Bosshard, *Landw. Versuchs-Stat.*, **33**). N. H. J. M.

Assimilation of Nitrates by Plants. By DEMOUSSY (*Compt. rend.*, 1894, **119**, 868—869; compare Abstr., 1894, ii, 153).—The roots of a number of colza plants were immersed in 100 c.c. of an aqueous potassium nitrate solution containing 20 milligrams of nitric nitrogen. In five days the solution was almost exhausted of nitrate, whilst the water taken up was only 26 c.c., corresponding with only about 5 milligrams of nitrogen. The plants were then supplied with a fresh solution of the nitrate. In seven days they again absorbed more nitrate than corresponded with the water taken up, after which the process was reversed. Even on increasing the evaporation by exposing the plants to the air (in June), there was no further absorption of nitrate. An examination of the plants showed that more than half of the nitrate still existed as such in the plants, the rest having become transformed into proteïds.

Whilst young plants from small seeds, such as colza and clover, absorb only a small amount of nitrate (9 milligrams and 6 milligrams of nitrate respectively per 100 plants), seedlings such as maize absorb as much as 400 milligrams of nitric nitrogen per 100 plants. This absorption depends on the amount of protoplasm, since, when the cotyledons were removed from the maize plants, the absorption was reduced to 31 milligrams.

The absorption of nitrates thus depends on the amount of nitrogenous matter in the young plants; if the nitrate had been directly employed in the production of proteïds necessary to the growth of the plants, the absorption would have been more active the more the proteïds were wanting. N. H. J. M.

Foraging Powers of some Agricultural Plants for Phosphoric acid. By W. BALENTINE (*Maine Agric. Exper. Stat. Bul.*, [2], No. 16, 1894).—Wheat, barley, maize, beans, peas, potatoes, and turnips were grown in sand (120 lbs.) contained in boxes. There were three sets in each case. Sodium nitrate (8·5 grams) and potassium chloride (2·6 grams) were applied to each box. The boxes of the first set had no phosphoric acid except that contained in the sand (0·012 per cent.); those of the second had S. Carolina rock (17 grams, containing 4·35 grams of insoluble phosphoric acid); and those of the third set acidified S. Carolina rock (28·5 grams, containing 4·46 grams of phosphoric acid three-fourths soluble).

The following amounts of dry produce were obtained (in grams).

Series.	I.	II.	III.	Series.	I.	II.	III.
Wheat	76·9	148·6	296·3	Beans....	15·7	17·4	69·8
Barley	201·5	294·9	508·1	Peas	112·7	196·7	228·6
Maize	39·5	103·3	291·0	Potatoes..	113·3	114·6	223·6
Turnips ...	154·4	304·1	270·4				

The results show that whilst wheat, barley, maize, peas, and turnips readily appropriated the phosphates of crude, finely-ground S. Carolina rock, beans and potatoes did not. Turnips benefited most, the yield being greater than was obtained with the soluble phosphates.

The acidified rock apparently decreased the yield of barley grain, but increased the amount of straw; with wheat, both grain and straw were about equally increased. N. H. J. M.

Nutrition of Green Plants by Glycerol. By E. ASSFAHL (*Ann. Agron.*, 1894, **20**, 496; from Inaug. Diss., Erlangen, 1892).—Filaments of spirogyræ, deprived of starch and immersed in 0·2 per cent. aqueous glycerol, produced starch in 2½ hours. This was in presence of light, precautions being taken to prevent chlorophyllous assimilation. The presence of potash has some effect on the production of starch from glycerol. N. H. J. M.

Formation and Decomposition of Organic Acids in Higher Plants. By K. PURJEWICZ (*Ann. Agron.*, 1894, **20**, 440—446; from *Bot. Centr.*, **58**, 368).—The periodic acidification and deacidification observed in many plants has frequently been investigated, notably by Warburg, who considers acidification to be a kind of "incomplete respiration," which goes on during the night when oxygen is less abundant in the plant.

Decomposition of acids takes place under the influence of light, of higher temperature, and of prolonged darkness. It is due to total or partial oxidation—the acid disappears much less quickly in an atmosphere of hydrogen than in air. As regards the effect of increased temperature, the acids disappear very quickly at first, then more slowly. In decomposing under the influence of light, the acids may indirectly supply materials for the production of carbohydrates; this would not be the case in absence of light, when, as has been shown, the amount of carbohydrates as well as of the acids become less. Bergmann showed the production of volatile fatty acids in portions of plants kept in the dark; it is probable that these are formed by the decomposition of the more complex non-volatile acids. Experiments on the effect of light and heat on organic acids, apart from plants, showed that malic acid decomposes easily under the influence of light, whilst oxalic and tartaric acids decomposed at a temperature of 40°. This shows why deacidification takes place most readily in plants containing malic acid. Submerged plants assimilate more easily in presence of malates, tartrates, and oxalates, doubtless owing to the production of carbonic anhydride.

All plants which deacidify in presence of light become acid in the dark, but only for a certain period, after which deacidification follows. Leaves floated on 2 per cent. solutions of glucose, cane sugar, lactose, and glycerol produced more acid than when water alone was employed; the relative effect produced by the different compounds corresponding with their importance as regards production of starch (A. Meyer and Laurent). The temperature most favourable to acidification is 12—15°. The presence of oxygen is more important for the production than for the destruction of acids.

The results of experiments with *Oxalis* and with *Pelargonium* show that the ratio CO_2/O_2 reaches its minimum at the temperature at which the greatest amount of acid is formed; at the temperature of 37—40°, at which the acids begin to decompose, the ratio approaches 1, or may even exceed it. Similar results were obtained when *Sedum hybridum* was kept in the dark; the ratio CO_2/O_2 rose from 0·44 to 0·70 in two days, and to 1·05 in five days, whilst the acidity fell from 360 to 300.

The oxygen absorbed by plants is, as Dehérain and Moissan suppose, largely used up in the production of acids. The plants in which the acidity varies most show also the most irregular coefficient of respiration. The intensity of respiration, measured by the carbonic anhydride evolved, is least in plants showing most acidity. The reverse, however, holds good in comparing the different parts of a plant.

Further evidence in favour of these views was obtained by placing etiolated haricot seedlings in water and in 3 per cent. glucose. Under the influence of glucose there was increased acidity, and coincidently diminished quotient of respiration:—With glucose $CO_2/O_2 = 0·40$, acidity = 257; with water alone $CO_2/O_2 = 0·72$, acidity = 185.

Ready-formed acids when given to plants may increase the destruction of acids, and consequently increase the evolution of carbonic anhydride. Etiolated wheat seedlings placed in water and in 2 per cent. calcium malate respectively for four days, and without light, gave the respiration coefficients 0·75 and 1·07. Haricots and *Sedum canescens* gave similar results.

The results (which confirm those of Warburg) show that the organic acids of plants are the products of the incomplete oxidation of carbohydrates. The evidence does not support the theory that they are the accessory products of the synthesis of proteïds. The destruction of acids is a process of combustion; there are degrees of combustion which do not immediately result in the production of carbonic anhydride, but in more or less oxygenated acids. N. H. J. M.

Mannan as a Reserve Material in the Seeds of Diospyros Kaki, L. By J. Ishii (*Bul. Coll. Agric. Imp. Univ., Tokyo*, 1894, **2**, 101—102).—The fruit of *Diospyros Kaki*, L. (date-plum), is largely consumed in Japan, owing to its richness in saccharine matter. When unripe, the fruit contains much tannin, which subsequently disappears. The flesh of the fruit is very rich in dextrose and levulose, but contains neither mannose nor galactose. The reserve matter of the seeds contains no starch, but consists of mannan, a polyanhydride of mannose. N. H. J. M.

Reserve Proteïn in Plants. By G. Daikuhara (*Bul. Coll. Agric. Imp. Univ., Tokyo*, 1894, **2**, 77—96).—It has recently been shown that the dissolved proteïn in plants is not always ordinary (passive) proteïn, but frequently a very unstable albuminous substance (active proteïn). This becomes converted into the passive form when the cell dies, and in many cases during the life of the cells. The gradual disappearance of active proteïn from the leaves is closely connected with the production of asparagine. Thus, in leaves of *Indicas glandulifera*, when kept in darkness for seven days, the percentage of asparagine rose from 0·218 to 0·606. The relation of total nitrogen to nitrogen as asparagine in leaves of *Pœonia albiflora* changed from 100 : 9·86 to 100 : 45·72 after being kept for 25 days in the dark. Various portions of a large number of plants (104 species) were examined for active proteïn. The substance was found in 51 plants (of 29 families); frequently in the flowers, in which case it may be absent in the leaves, or decrease in those parts nearest the flower. In *Gramineæ*, active proteïn was only found in the seed epidermis, and only at a certain period of development. Active proteïn is formed in larger amounts in full sunlight than in the shade, and young leaves are richer in it than old ones. When suffering from albinism, leaves show it equally in the white as in the green parts.

N. H. J. M.

Mucin in Plants. By J. Ishii (*Bul. Coll. Agric. Imp. Univ., Tokyo*, 1894, **2**, 97—100).—Whilst the animal slimes belong to the proteïn compounds, those hitherto found in plants are carbohydrates. The investigation of the slimy matter found in the tuberous roots of yams (*Dioscorea japonica*, Humb., and *D. batates*, Decaigne) showed them to contain a kind of mucin. This was prepared by Obolenski's method (*Pflüger's Archiv*, 4), and was found to possess all the essential characteristics of animal mucin ; it is, however, more sparingly soluble in dilute alkalis, and yields a turbidity with potassium ferrocyanide. The percentage composition was found to be C = 52·82, H = 7·53, N = 14·20, Ash = 0·41, and O + S (by difference) = 25·05. The tubers, dried at 100°, contained 8·0 per cent. of the substance.

N. H. J. M.

Localisation of Oxalic acid in Plants. By R. GIESSLER (*Ann. Agron.*, 1894, **20**, 446—447 ; from *Jena. Zeits. Naturw.*, 1893, [2], **20**, 314).—The plants selected for experiment belonged to the families *Rumex*, *Oxalis*, and *Begonia*. Oxalic acid is generally found in the epidermis or in the peripherical tissues, and forms a protection against the attacks of small animals. The underground portions of the plants are, as a rule, free from oxalic acid. The leaves in particular accumulate the acid in the epidermis, the underlying tissues containing much less. Accumulations also occur in the stems and various other parts of the plants, even in the pith.

Another function of oxalic acid accumulated in the epidermis, is in relation to the function of reservoir of water served by this tissue.

N. H. J. M.

Levulose from the Dried Peel of Citrus Aurantium Chinensis. By B. W. BAUER (*Landw. Versuchs-Stat.*, 1894, **45**, 293—294).—The dried orange peel (50 grams) was softened with acetic acid and boiled with water : 4·794 grams of crude sugar was obtained. After treatment with animal charcoal, 1·458 grams of a very hygroscopic substance was obtained, $[\alpha]_D = -85·24°$. The rotation did not change after 24 hours. The animal charcoal employed for decolorising was covered with white rosettes of crystals. N. H. J. M.

Occurrence of Vanillin. By E. O. v. LIPPMANN (*Ber.*, 1894, **27**, 3409).—The author has separated vanillin from the flowers of *Nigritella suaveolens*, a variety of orchid; the extract of the plant also contains a substance recalling heliotropin or piperonal in odour.

A. R. L.

Poisonous Action of Dicyanogen. By O. LOEW and M. TSUKAMOTO (*Bul. Coll. Agric. Imp. Univ., Tokyo*, 1894, **2**, 35—41). —It has been suggested by Loew (*Nat. System d. Giftwirkungen, München*, 1893) that the great stability of the proteïd matter composing the living organism is caused by the simultaneous presence of aldehyde and amido-groups. If this be the case, any substance which reacts, when highly diluted, either with aldehyde or amido-groups must act poisonously on every living organism. Both dicyanogen and hydrogen cyanide should be poisonous.

A number of experiments were made to ascertain the effect of these two compounds in very dilute solution (1 : 400 to 1 : 100,000) on microbes (compare Liebig, *Annalen*, 1874, **153**, 137), yeast cells, algæ (*Spirogyra communis*), phenogams (radishes, barley, lupins, and narcissus, also seeds of peas, &c.), and lastly on lower aquatic animals (nematodes, rotatoria, copepods, &c.) It was found that both dicyanogen and hydrogen cyanide are general poisons, dicyanogen being the stronger of the two. In experiments with white rats, however, hydrogen cyanide proved to be the stronger poison, probably because dicyanogen becomes largely changed in the blood before it can reach the nervous tissues.

The author supposes that hydrogen cyanide does not poison yeast cells as such, but that it undergoes decomposition in the yeast cells before it can act poisonously. N. H. J. M.

Poisonous Action of the Hydroxy-derivatives of Benzene on Yeast and Bacteria. By K. YABE (*Bul. Coll. Agric. Imp. Univ., Tokyo*, 1894, **2**, 73—75).—The poisonous effect of the hydroxybenzenes increases generally with the number of hydroxyl-groups. The three dihydroxy-derivatives, however, differ considerably from each other in this respect, and of the tri-derivatives, phloroglucinol is less poisonous than pyrogallol.

Equivalent amounts of different phenols were dissolved in Pasteur solution and yeast added. In a second experiment, the yeast was first shaken with the solution and then kept for 70 hours; this experiment was also made with bacteria; the results, which are given in tables, show that in the case of the lower fungi, the higher hydroxy-derivatives are less poisonous than phenol itself (compare Biernacki, Abstr., 1893, ii, 32; Loew, *Nat. System d. Giftwirk.*).

N. H. J. M.

The Vegetable Cheese, Natto. By K. YABE (*Bul. Coll. Agric. Imp. Univ., Tokyo*, 1894, **2**, 68—72).—The vegetable cheese, natto, has been prepared in Japan since remote times. It is obtained by keeping Soja beans, previously well softened by being boiled in water, wrapped up in straw, in a well-closed, heated cellar for 24 hours. It forms a soft mass in which the beans are held together by a very thick viscous substance, and has a peculiar odour. Three micrococci (yellow, orange-yellow, and white colonies) and a bacillus, derived from the air or from the straw, were obtained from the cheese.

The following numbers show the percentage of the different forms of nitrogen in natto and in the beans from which it was prepared.

	Total nitrogen.	Nitrogen as proteïds.*	Nitrogen as amides.	Nitrogen as peptone.
In Soja beans	7·355	6·899	0·128	0·328
In natto..........	7·542	4·033	1·892	1·617

Tyrosine, leucine, hypoxanthine and xanthine were found in the cheese; lysine, lysatinine, and arginine, which occur in germinating lupins could not be detected.

There can be no doubt that much of the peptone and also the leucine and tyrosine are products of bacteriological action. There can be hardly any doubt that the cheese is more digestible than the original beans. N. H. J. M.

Saline Composition of Potatoes and Oats. By PAGNOUL (*Ann. Agron.*, 1894, **20**, 467—479).—Potatoes were grown in 12 pots containing each 25 litres of white sand, manured as follows:—Nitrogen (as ammonium sulphate or the nitrates of calcium, potassium, and sodium), the chlorides, phosphates, sulphates, and carbonates of calcium, potassium, and sodium, so that there were series of the three bases (CaO, K_2O, and Na_2O) and of the four acids (HCl, H_2SO_4, HNO_3, and H_2CO_3), nitrogen and phosphoric acid being applied to all 12 pots. A table is given showing the produce and ash constituents obtained under the twelve different conditions. As regards the plant development, potassium had a marked effect, the average amount of dry matter being 93·4 grams as against 65·6 grams with calcium, and 55·6 grams with sodium. Sodium cannot take the place of potash, and is taken up, if at all, only in small quantity. Potassium, as well as calcium and sodium, seem to be most readily absorbed in the form of nitrate.

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* Excluding peptone.

Oats were then grown in the same pots as were used for potatoes after they had been exposed to rain during the winter. The results are given in tables. As in the case of potatoes, potassium was the most beneficial base for oats; taking the yield of oats grown under the influence of potassium as 100, the yield with sodium was 71, and with calcium 43.

The following table shows the composition of the ash of oats (per cent. in dry matter) manured (1) with potassium, (2) sodium, and (3) calcium.

	K_2O.	Na_2O.	CaO.	P_2O_5.
Potassium manure....	7·001	—	0·634	3·043
Sodium ,, ...	1·192	4·585	0·682	1·983
Calcium ,, ...	0·934	0·920	1·956	1·300

The results are very different from those obtained with potatoes; the potassium is higher when it is applied, whilst there is no sodium taken up under these conditions. Sodium is taken up largely when given to the plants, whilst, when the plants have to depend on the sodium and potassium originally present in the sand, the amounts of both bases taken up are about the same. The amount of phosphoric acid increases with the amount of total alkali; it is probably assimilated most readily when combined with potassium. As regards nitrogen, a comparison is made between the produce of Pot 8 (potassium nitrate and phosphate) and that of Pot 11 (ammonium sulphate, potassium phosphate, and carbonate). Whilst, at first, the plants of Pot 8 were the more vigorous, they subsequently became feeble and yellow, those of Pot 11 remaining dark green. The nitrate plants were found to be richer in total nitrogen, and much richer in nitrates than the ammonium plants, whilst the latter contained considerably more phosphoric acid. The higher amount of phosphates, possibly due to the presence of potassium carbonate, is supposed to be the chief cause of the superiority of the ammonium plants, and it is thought that the nitrate plants absorbed the nitrogen too quickly for its assimilation.

N. H. J. M.

The Compounds of Phosphoric acid in Superphosphate Soluble in Water. By J. Stoklasa (*Landw. Versuchs-Stat.*, 1894, **45**, 161—172; compare Abstr., 1891, 880, and 1893, ii, 549).—The amount of calcium carbonate was determined in the drainage from soils derived from primitive rocks and from chalk formation, and from humus soil. The results show that a relatively large amount of carbonate is dissolved. It is estimated that the yearly loss of calcium carbonate is over 560 kilos. per hectare in the case of soils from primitive formations, and as much as 3,000 kilos. from chalky soil. The results are of interest as bearing on the loss of phosphoric acid. A litre of water saturated with carbonic anhydride, and containing calcium hydrogen carbonate (0·268 gram), held in solution 0·252 gram of $CaH_4(PO_4)_2$, corresponding with 0·346 gram of tricalcium phosphate, supposing this to be formed.

The total phosphoric acid of four soils is compared with the amounts of phosphoric acid found in the drainage from the soils, and the estimated loss per acre. The four soils were (1) loam from granite and gneiss formations, (2) clay from permean formation, (3) marl, and (4) humus soil.

	Loamy soil.	Clayey soil.	Marl.	Humus soil.
Total P_2O_5 per cent.	0·024	0·087	0·125	0·008
P_2O_5 in drainage per million	0·620	0·420	0·700	1·010
Estimated annual loss per hectare (grams)	13,492	9,146	15,244	21,995

The results show in a striking manner the enormous loss in the humus soil which contains the lowest percentage of phosphoric acid (compare Fleischer, *Untersuchungen üb. d. Verhalten schwerlösl. Phosphate im Moorboden, &c.*, *Landw. Jahrb.*, 1883, **3**, 121—201).

As regards the estimation of total phosphoric acid in soils, hydrochloric acid seems to be the most suitable solvent. Boiling nitric acid gives too high results with humus soil, owing to the oxidation of organic phosphorus compound (compare van Bemmelen, Abstr., 1890, 1339, and M. Schmöger, *Ber.*, 1893, **26**, 386).

When superphosphate is treated with only a slight excess of acid so as not to completely decompose the monocalcium phosphate, $CaH_4(PO_4)_2$, the calcium sulphate from the calcium carbonate encases the orthophosphoric acid and the untransformed tricalcium phosphate, which, in course of time, interact, forming monocalcium phosphate. Hard globules from fresh superphosphate contained, as $CaH_4(PO_4)_2$, 10·66 per cent. of P_2O_5; as H_3PO_4, 7·95 per cent.; and as $Ca_3(PO_4)_2$, 2·06 per cent. After 60 days, the following amounts of phosphoric anhydride were found :—As $CaH_4(PO_4)_2$, 21·86 per cent.; as H_3PO_4, 0·59; and as $Ca_3(PO_4)_2$, 0·62 per cent.

Superphosphate from bone-meal containing 16·21 per cent. of phosphoric anhydride as monocalcium phosphate, and 2·43 per cent. as phosphoric acid, gave globules containing 5·01 per cent. of phosphoric anhydride as monocalcium phosphate, and 11·59 per cent. as phosphoric acid; they also contained gypsum. A filtered 1 per cent. solution deposited, after a few days, stellate groups of crystals of calcium sulphate along with a fungus, *Beggiatoa alba.* This is characteristic of superphosphate solutions, especially those of animal origin. Chloroform and carbon bisulphide prevent the separation of the crystals and the development of the organism, but the organism will vegetate in solutions of phosphates containing arsenious anhydride (0·05 gram per litre) and arsenic acid (0·2 gram per litre). *Beggiatoa alba* also grows well in solutions of the beryllium and nickel salts, $BeH_4(PO_4)_2$ and $NiH_4(PO_4)_2$. The production of the stellate groups of calcium sulphate crystals with the organism *Beggiatoa* only occurs in presence of phosphoric acid. The author's observations as regards the micro-organism do not agree with Winogradsky's. No hydrogen sulphide was produced from calcium sulphate in any of the cultivations. The chemistry of the fungus requires further study.

Monocalcium phosphate does not seem to react with calcium sulphate at all, and orthophosphoric acid has practically no action (compare Jones, *Landw. Versuchs-Stat.*, **13**). N. H. J. M.

Drainage from Cultivated Soils. By P. P. DEHÉRAIN (*Ann. Agron.*, 1894, **20**, 449—466; compare Abstr., 1894, ii, 291).—The results obtained from March, 1893, to March, 1894, are now given. There were four fallow cases and sixteen others with grass, wheat, sugar-beet, barley, potatoes, and vines. Tables are given showing the amount of manure applied in 1893 and in 1892, the treatment of the soil—whether dug or not—the produce, and the nitrogen balance. As regards the amount of nitrates from fallow, there was much less than previously. Taking case No. 1 (without manure from commencement), the drainage in spring and summer of 1892 contained 0·158 gram per litre, in autumn and winter of 1892–93, 0·106, and in the whole year, March, 1893—March, 1894, only 0·079. Digging the soil had some effect, especially in November, but the total loss was not as great—comparing it with that from the soil left in rest—as might be expected, owing perhaps to the whole soil having been so recently disturbed in filling the cases.

The cases in which there was vegetation did not yield such large crops as previously. There was considerable loss of nitrates in the drainage from wheat, owing to the mildness of the winter having been favourable to nitrification. In two cases out of three, the loss of nitrogen in the drainage was greater than the amount found in the crop.

The losses of nitrogen from soil depend less on the abundance of crops than on the activity of nitrification, caused by climatic influence and the treatment of the soil. The loss is diminished by a good crop, partly by directly taking up the nitrates and partly by diminishing the amount of drainage.

The dry spring of 1893 was fatal to the sugar-beet, and the yield was much lower than the year before. The plants took up less nitrogen than the wheat, and there was less loss by drainage.

The vines took up but little nitrogen, and the loss by drainage was almost the same as from the fallow.

The yield of potatoes was good, and they took up in each case more nitrogen than was supplied in the manure. The losses in drainage were not great, but higher than was observed in the case of sugar-beet. Generally speaking, a good yield of sugar-beet takes up more nitrogen than potatoes, but it leaves more nitrogenous residues than potatoes, and, moreover, remains in the soil to a later period, and thus retains the considerable amount of nitrates found at this time.

The results of the experiments show what considerable losses of nitrogen there may be from fallow land—losses which nitrogen-fixing organisms cannot compensate. The practice of fallow should be discontinued.

The question as to how far the working of the soil will diminish the necessity of sodium nitrate will be next considered.

N. H. J. M.

Analytical Chemistry.

Instruments for the Graduation and Calibration of Volumetric Apparatus. By H. N. Morse and T. L. Blalock (*Amer. Chem. J.*, **16**, 479—488).—The authors describe simple apparatus whereby flasks, burettes, and gas tubes may be readily verified, graduated, and calibrated. It consists of a glass vessel of known delivering capacity, with a graduated stem (to enable it to be used for graduating vessels for different temperatures), to which is attached at its lower end a Greiner and Friedrich's two-way stop-cock, which is in turn connected by a rubber tube with a supply of distilled water placed somewhat higher than the instrument itself, and also with a jet, from which the known volume of water is delivered into the vessel to be calibrated. G. T. M.

Electrometric Analysis. By R. Behrend (*Zeit. physikal. Chem.*, 1894, **15**, 498).—The author finds that all potential differences given in his previous paper (Abstr., 1893, ii, 387) are too low in the ratio 1·092 : 1. Although the relative values remain unchanged, the absolute values must be altered in this proportion. H. C.

Notes on Volumetric Analyses. By B. Reinitzer (*Zeit. angw. Chem.*, 1894, 547—554, 574—579).—The paper is chiefly devoted to proving the superiority of litmus over methyl-orange as an indicator. Absence of carbonic acid is, however, of great importance. Errors arising from carbonic acid in the titration of acids cannot be wholly avoided by substituting lime or baryta water for caustic alkalis, as even the former have the property of dissolving traces of calcium or barium carbonate. A warning is given as to using ordinary glass vessels for concentrating or boiling liquids which have to be titrated. For instance, in estimating the amount of alkali carbonate in mineral waters, the results may turn out quite untrustworthy, owing to the amount of alkali dissolved from the glass. Flasks made of Jena glass are, however, quite proof against the action of water.

Ammonia, obtained by distilling a known weight of pure ammonium chloride with aqueous potash, is recommended for standardising acids. L. de K.

Sensitiveness of Zone Reactions and their Use in Testing for Acids. By H. Trey (*Zeit. anal. Chem.*, **33**, 533—543).—To avoid the troublesome neutralisation required for the qualitative detection of certain acids by silver, barium, or calcium, the author prefers the method of superposing an excess of the neutralising reagent upon the solution to be tested, and observing only the zone of contact. The usual solution, containing no other metals than those of the alkalis, is acidified with nitric acid. Then to test for phosphoric, arsenic, arsenious, chromic, oxalic, boric, sulphurous, thiosulphuric, or silicic acids, an excess of silver nitrate is added, and any precipitate produced is removed by filtering. The perfectly clear filtrate is then carefully covered with a layer of ammonia, when any of the above acids will afford a turbidity at the zone of contact.

Another portion is treated with hydrochloric acid and barium chloride, some calcium chloride is added to the filtrate, and then a layer of sodium acetate. Here chromic, oxalic, and hydrofluoric acids give turbidity. A great advantage of the method is the sensitiveness of the reactions under these conditions. One gram-equivalent of the respective acids can be detected at the following dilutions.

By silver: boric and silicic acids in 100 litres; phosphoric, arsenic, and arsenious acids in 1,000 litres; chromic acid in 10,000 litres; oxalic acid in 100,000 litres. With barium and calcium, chromic acid gives a precipitate at 1,000 litres; oxalic and hydrofluoric acids at 100 litres. Confirmatory tests must be used to decide which of the above acids is present. M. J. S.

Correction in the Determination of the Titre of a Liquid holding a Precipitate in Suspension: Application to Saccharimetry. By E. Lenoble (*Bull. Soc. Chim.*, 1894, [3], **11**, 336—343).—When a solution holding a precipitate in suspension is titrated, the result is erroneous by an amount proportional to the increase in volume of the solution caused by the precipitate. The following methods, which are of general application, enable the true results to be ascertained.

By the first method, a known volume, V, of the turbid solution is allowed to settle as much as possible, and a small quantity filtered under pressure. A known small volume, L, of the clear filtrate is titrated, and the percentage result, A, determined. The remainder of the filtrate and the precipitate are returned to the original solution, and the volume again made up to V. The operation is now repeated on this more dilute solution, with the percentage result B. Then, if P and S be the true volumes of the precipitate and solution, K the actual weight of titratable substance in the latter, and x its true percentage amount—

$$x = A_2L/V(A - B) \text{ and } K = A^2L/100(A - B).$$

A special air-pressure filter attached to a burette is used for the first filtration.

By the second method, the procedure is much the same, except that the filtration is effected through very small filters of uniform capacity

(0·5 c.c.), and the titration effected three times, the volume L′ and the result C being introduced into the calculation.

$$K = AL\{B(A + B) - 2AC\}/100\{B(A + C) - 2AC\},$$
$$x = AL\{B(A + B) - 2AC\}/V\{B(A + C) - 2AC\}.$$

A modification of this method, involving the use of an air-pressure filter, is also described.

Some specimen results of the application of these methods to the polarimetric estimation of sugar in products incidental to brewing show that the correction is very considerable. JN. W.

Estimation of Chlorine in Commercial Iodine. By F. ULZER and A. FRIEDREICH (*Zeit. anal. Chem.*, **33**, 595—596; from *Mitt. k. k. techn. Gewerbemuseums*, 1892, 287).—Ten to twenty grams of the sample is dissolved in 100 c.c. of carbon bisulphide in a separator; 5—10 c.c. of water is added and shaken. The iodine chloride dissolves in the water, which also becomes saturated with iodine. A standard solution of potassium iodide is now run in. This, reacting with the iodine chloride, causes a liberation of iodine, which appears as a turbidity in the aqueous layer, and the addition is continued until it no longer produces turbidity. M. J. S.

Detection of Iodine in Urine. By A. JOLLES (*Zeit. anal. Chem.*, **33**, 543—546).—The author compares the sensitiveness of his method (Abstr., 1891, 1288), which consists in mixing 10 c.c. of the urine with an equal volume of concentrated hydrochloric acid and running 2—3 drops of a weak solution of bleaching powder down the side of the test-tube, and then adding starch solution, with that of Sandlund (Abstr., 1894, ii, 429), and finds that, although the latter is the more sensitive in aqueous solutions, this is not the case in urine. The lower limit is for Sandlund's test 0·003825 gram, and for his own 0·00153 gram of iodine in 100 c.c. After taking copaiba balsam, compounds occur in the urine which absorb iodine and impair the sensitiveness of the test. In this case, 10 c.c. of the urine is to be shaken with 5 c.c. of chloroform and filtered before testing.

For quantitative estimation, the author's method, as well as either of Sandlund's, gives satisfactory results. M. J. S.

Estimation of Organic Sulphur. By L. L. DE KONINCK and E. NIHOUL (*Chem. Centr.*, 1894, ii, 343; from *Mon. Scient.*, [4], **8**, 1894, 504—508).—The authors oxidise the organic substance with a mixture of calcium nitrate and calcium oxide. The combustion is done as usual in a glass tube, in the same way as the halogens are estimated. The contents of the tube are afterwards digested in dilute hydrochloric acid, and precipitated with barium chloride.

The oxidising mixture is made by dissolving 1 part of calcium nitrate in ½ part of water, and adding 5 parts of calcium oxide. The mixture is then thoroughly dried and powdered. L. DE K.

Estimation of Sulphur in Volatile Organic Compounds. By C. F. MABERY (*Amer. Chem. J.*, 1894, **16**, 544—551).—The author describes the method and apparatus he employs in the rapid determination of sulphur in petroleum. It consists of a modification of Sauer's process (this Journal, 1873, 289), improved by Burton (Abstr., 1890, 289). The combustion is effected in a stream of air supplied under pressure, and the resulting products are absorbed in a solution of sodium hydroxide of known strength, which is subsequently titrated against standard sulphuric acid. G. T. M.

Detection of Traces of Metallic Sulphides in Precipitated Sulphur. By R. Fresenius (*Zeit. anal. Chem.*, **33**, 573—574).—It is not unfrequent in qualitative analysis to obtain a considerable precipitate of sulphur, in which traces of the yellow sulphides of cadmium, arsenic, or tin may be present without being visible. By half filling a test-tube with the turbid mixture, adding a layer of benzene or light petroleum 2 cm. high, shaking violently for a minute, and then leaving in repose for another minute, the sulphur passes entirely into the organic solvent, whilst the sulphides are left as films, partly between the two layers of liquid, but mainly on the walls of the tube above the liquid. Should metallic sulphides be found to be present, it is best to treat a larger portion of the liquid in a similar way, and then filter the liquid through a wetted filter. After allowing the aqueous solution to drain away completely, the sulphur solution can be poured from the filter, to which the sulphides for the most part adhere firmly, and the filter can then be washed with water. Only in such exceptional cases as the decomposition of hydrogen sulphide by sulphurous or nitrous acids, is the precipitated sulphur insoluble in benzene or petroleum. M. J. S.

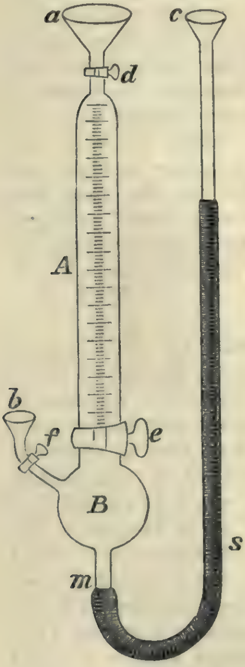
Volumetric Estimation of Sulphuric acid. By W. Windish (*Chem. Centr.*, 1895, ii, 108; from *Wochschr. Brauerei*, **11**, 607—609).—*Estimation of Combined Sulphuric acid in Waters.*—100 c.c., or more, of the sample is acidified with hydrochloric acid, boiled, neutralised with ammonia, and boiled with 50 c.c. of N/15 solution of barium chloride. 50 c.c. N/50 solution of potassium chromate is then at once added, and after boiling for another minute or two the whole is rinsed into a 300-c.c. flask. After cooling, water is added up to the mark, the mixture well shaken and filtered, 100 c.c. of the filtrate is then mixed with 50 c.c. of N/50 solution of arsenious acid and 5 c.c. of 20 per cent. sulphuric acid, and after the liquid has become colourless 100 c.c. of a saturated solution of sodium hydrogen carbonate is added, then a little starch solution, and the excess of arsenious acid is titrated with N/50 solution of iodine. If T_1 be the titre between the iodine and the arsenious acid, T_2 the titre between arsenious acid, and potassium chromate, and J the number of c.c. of iodine solution used then—

$$x = \frac{12(T_1 - J)}{T_1 - T_2} = \text{grams of } SO_3 \text{ in 100 c.c. of water.}$$

Estimation of Sulphuric acid in Insoluble Sulphates.—These are converted into sodium sulphate by fusing with sodium carbonate. The solution is then treated as before. L. de K.

Estimation of Nitrogen in Guano. By E. HASELOFF (*Landw. Versuchs-Stat.*, 1894, **45**, 289—292).—Twenty samples of crude and decomposed guano were analysed by the Jodlbauer and by the Ulsch-Kjeldahl methods. In some cases, both methods gave practically the same results, but in many cases the results obtained by the Ulsch-Kjeldahl method were considerably higher. In order to ascertain if these results had any relation to the amount of nitrate present, the nitric acid was separately determined in each case. The results were, however, not sufficiently definite to allow such a conclusion being drawn. The Jodlbauer method should be tested, and in the meantime the Ulsch-Kjeldahl employed.

An attempt to reduce the nitrate in the guano itself by Ulsch's method, and to afterwards burn by Kjeldahl's method was unsuccessful (compare Süllwald, Abstr., 1892, 528). N. H. J. M.



New Mercury Ureometer. By A. G. BARBERA (*Chem. Centr.*, 1894, ii, 297; from *Ann. Chim. Farm.*, **15**, 341—346).—The object of the apparatus (see illustration) is to measure the volume of nitrogen evolved by the action of alkaline hypobromite on urea. The apparatus is filled with mercury by pouring the same into the funnel *c*, after having first opened the taps *e*, *d*, and *f*. After closing the taps, a quantity of urine is put into *a*, and, after opening *d*, it is drawn into the burette *A* by lowering the tube *s*. It is then measured, the 50-c.c. burette being divided to 0·1 c.c. The funnel *b* is now filled with alkaline hypobromite, *e* is closed, and the greater part of the solution is drawn into *B* by again lowering *s*, when *f* is at once closed. The tap, *e*, is now opened, which will cause the hypobromite to ascend in the burette and mix with the urine. The liberated nitrogen is then measured as usual. L. DE K.

Estimation of Phosphoric acid by the Citric acid Process. By F. GLASER (*Zeit. angw. Chem.*, 1894, 543—545).—The author has conclusively proved that when the *citrate process* is used a very large excess of magnesia mixture is essential for success. In presence of much calcium and iron, this precaution is, perhaps, superfluous, but, in most cases, when excess of magnesia fails, the precipitate is not the well-known triple phosphate, but consists more or less of a compound having the formula

$$Mg(NH_4)_4(PO_4)_2,$$

which, on ignition, is converted into pyrophosphate, whilst the liberated phosphoric anhydride is volatilised. L. DE K.

Estimation of the Value of Phosphates insoluble in Water. By E. Wrampelmeyer (*Landw. Versuchs-Stat.*, 1894, **45**, 187—194; compare Abstr., 1894, ii, 119).—With a view to ascertain which is the most suitable method for estimating the value of phosphates insoluble in water, a number of different phosphates were extracted by the methods of Jensch (5 per cent. citric acid), Scheibler (ammonium citrate with 1 per cent. of citric acid), Petermann (ammonium citrate and 1 per cent. of ammonia), and H. v. Liebig (hydrogen potassium oxalate). The total phosphoric acid was also determined in each case; Jensch's method gave too high values with most phosphorites and with basic slag, but not with Redonda phosphate. v. Liebig's method also gave high results, except in the case of the sandy Malogne (Ciply) phosphate, and basic slag. Both methods are untrustworthy. Both Scheibler's and Petermann's methods give better results, but it would be desirable to modify Petermann's method so as to make it quicker and less troublesome. Manuring experiments should be made with the various calcium phosphates, and with basic slag and phosphorites, and the results compared with those of the laboratory. It is also proposed to make vegetation experiments to ascertain the effect of species in the assimilibility of phosphoric acid (compare Balentine, this vol., ii, 126). N. H. J. M.

Analysis of Zinc Ores. By E. Jensch (*Zeit. angw. Chem.*, 1894, 541—543).—The author proposes to use hydrogen peroxide instead of nitric acid to oxidise the iron in a zinc analysis. This is particularly to be recommended when the ore, or refuse, contains much manganese, as this will separate out completely with the iron when excess of ammonia is added. If the sample should contain about 5 per cent. of alumina, the precipitate must be redissolved and reprecipitated at least three times to free it from zinc. When titrating the solution with sodium sulphide, the author prefers ferric chloride as indicator. To estimate zinc oxide in weathered sulphide, the sample, which must be reduced to an extremely fine powder, is repeatedly boiled with 25 per cent. ammonia, and the united filtrates titrated.

When testing zinc ash, too much stress cannot be laid on the necessity of getting a representative sample. The author advises selecting a large sample and separating it, by means of a sieve, into several portions, each of which is then separately analysed. Some kinds of silicates contain the zinc in the form of *spinel*, when it is quite insoluble in acids, but as it is also unreducible and yields, in consequence, no metal, it need not be included in the analysis.

L. de K.

Rüdorff's Process of Electrolysis. By H. Thomälen (*Chem. Zeit.*, 1894, **18**, 1121—1122).—The author's objection to Rüdorff's process (Abstr., 1893, ii, 391) is the use of Meidinger cells and the imperfect means used to ascertain the real strength of the galvanic current. The use of accumulators is recommended. L. de K.

Electrolytic Estimation of Copper in Ammoniacal Solution. By F. Oettel (*Chem. Zeit.*, 1894, **18**, 879—881).—Although generally speaking copper is best deposited from acid solutions, still, in the presence of chlorine, arsenic or small quantities of antimony, it will be found better to electrolyse it in an ammoniacal liquid. The presence of zinc is of no consequence, but if lead, bismuth, mercury, cadmium or nickel are present the results will be somewhat too high.

To ensure success the amount of copper should not exceed 0·8 gram per 100 c.c., and a wire-shaped positive electrode should be used. To obtain a solid deposit, the liquid should contain a large amount of ammonium nitrate, but only a slight excess of ammonia. The density of the current should be 0·07—0·27 amp. per square dm.

L. DE K.

Indirect Volumetric Analyses by means of Sulphurous acid. By D. VITALI (*Chem. Centr.*, 1894, ii, 175—176; from *Boll. Chim. Farm.*, 1894, **9**).—*Estimation of Mercuric Chloride.*—The liquid, which must be neutral, is heated with sulphurous acid to 70—80° to precipitate the mercury as mercurous chloride. After filtering, the excess of sulphurous acid is expelled by heating to 60—80°, and the liberated hydrochloric acid is titrated with N/10 soda and phenolphthaleïn. One mol. of hydrogen chloride = 1 mol. of mercuric chloride.

Estimation of Copper Sulphate.—Solution of copper sulphate is mixed with excess of potassium iodide, and after adding some starch solution, sulphurous acid is slowly added until the liquid is just decolorised. The liberated sulphuric acid is then titrated with N/10 soda and phenolphthaleïn. 1 c.c. of soda = 0·012469 of crystallised copper sulphate. Sulphurous acid may, in turn, be estimated by means of copper sulphate.

L. DE K.

Estimation of Iron and Aluminium in Phosphates. By V. EDWARDS (*Chem. News*, 1894, **70**, 297).—A gram of the pulverised sample is heated with ammonium citrate, at about 60°, for half an hour, filtered and washed, any cloudiness being dispelled by boiling with a little nitric acid. Citro-magnesia solution and excess of ammonia are added and well stirred in, then after two hours the phosphate precipitate is collected, washed, dried, ignited, and weighed. The filtrate is treated with ammonium sulphide, the ferrous sulphide washed, dissolved in dilute sulphuric acid, boiled, cooled, and titrated with permanganate. The aluminium is found by difference.

D. A. L.

Volatility of Stannic Chloride. By T. M. DROWN and G. F. ELDRIDGE (*Zeit. anal. Chem.*, 1894, **33**, 598—601; from *Technology Quarterly*, **5**, 136).—Solutions of stannic chloride, acidified with hydrochloric acid and heated, suffer loss of tin the more rapidly the larger the percentage of tin, the greater the amount of free acid, and the higher the temperature. A strongly acidified solution loses tin rapidly even at 100°, and by repeated evaporation with fresh acid the whole of the tin can be volatilised. 0·64 gram of tin required 5 evaporations, of 40 c.c. of strong hydrochloric acid each, on the water bath. Tin can be quantitatively separated from lead, probably from other metals also, in this way.

Solutions sufficiently dilute, or only feebly acid, may, however, be heated for some time without appreciable loss. When, by evaporation, a certain degree of concentration is reached, a precipitate of a non-volatile stannic hydroxide begins to separate, and for equal degrees of acidity the concentration at which this occurs is the same, whether the evaporation has been carried on at 100° or 200°.

M. J. S.

Estimation of Alcohol in so-called Essential Oils. By C. Fabre, Garrigou, and Surre (*Compt. rend.*, 1894, **119**, 747—748).—The usual method of estimating the alcohol in the so-called "essential oils," obtained in the manufacture of alcohol, is to agitate the oil with four successive quantities of a saturated aqueous solution of sodium chloride, remove the amylic alcohol from the latter by carbon bisulphide, distil the saline liquid, and estimate the ethylic, propylic, and isopropylic alcohols in the distillate by means of potassium permanganate.

Direct experiments on mixtures of known composition show, however, that this method only estimates from 25 to 30 per cent. of the alcohols present.

If, on the other hand, the oils are subjected to several successive series of treatments with four washings with salt solution, a much larger quantity of alcohols is extracted.

	A.	B.	C.
First series ..	8·9 per cent.	6·25 per cent.	6·2 per cent.
Second ,, ..	5·4 ,,	3·55 ,,	3·8 ,,
Third ,, ..	3·2 ,,	2·7 ,,	2·1 ,,
Fourth ,, ..	1·9 ,,	1·4 ,,	1·15 ,,
Fifth ,, ..	1·0 ,,	0·85 ,,	0·75 ,,
Sixth ,, ..	0·7 ,,	0·45 ,,	0·30 ,,
Seventh ,, ..	0·5 ,,	0·35 ,,	0·25 ,,
Eighth ,, ..	0·25 ,,	0·25 ,,	0·20 ,,
	21·85	15·80	14·75

C. H. B.

Estimation of Mannitol by the Optical Method. By J. A. Muller (*Bull. Soc. Chim.*, 1894, [3], **11**, 329—336).—Aqueous solutions of pure mannitol are practically inactive, but become more or less active in the presence of certain inorganic substances, themselves also inactive, such as borates, arsenates, &c., a solution of mannitol containing borax, for instance, being dextrogyrate. The rotatory power, moreover, of solutions containing a constant proportion of mannitol, increases with the relative amount of borax present, which must, therefore, be kept constant. The quantity used formed a nearly saturated solution. The mannitol was carefully purified. The observations were made with a Laurent polarimeter, using a tube 500 mm. long, illuminated by sodium light. The temperature of the solutions was approximately 16°, but the effect of slight alterations of temperature was negligeable. In the following table of results, y = weight of mannitol in grams contained with 1·4 grams of anhydrous borax in 50 c.c. of solution at 16°, x = rotation at 16° in degrees and minutes (each the mean of three readings).

y.	*x.*	*y.*	*x.*
0·101	0° 20·8′	1·512	4° 1·0′
0·299	1 1·3	1·638	4 12·2
0·506	1 41·1	1·761	4 23·0
0·756	2 20·7	2·003	4 42·8
1·006	3 0·8	2·223	4 58·2
1·254	3 31·8	2·509	5 12·8
1·352	3 43·2	3·015	5 25·7

The corresponding curve closely resembles an equilateral hyperbola, but is probably composite. The increment of mannitol required to increase the rotation 10 minutes gradually increases from 0·050 gram for the first 1° 40′ to 0·062 gram at 3°, 0·089 gram at 4°, 0·144 gram at 5°, and 0·465 gram at 5° 25′. Above 5°, the weight of mannitol (y) dissolved under the conditions specified is connected with the rotation (x, in minutes) caused by it by the equation $y = \frac{43\cdot407}{353\cdot14 - x} + 1\cdot433$. This leads to a maximum rotation of 5° 33′, which no further addition of mannitol can increase. The amount of mannitol in the solution, therefore, must not be greater than 3 per cent.

To ascertain the influence on the accuracy of the process of the various substances associated with mannitol in wine, the rotatory powers of their solutions were determined before and after the addition of borax. Sodium lactate and glycerol caused no rotation in either case; the rotatory powers of rochelle salt, gum arabic, and sodium malate were slightly, that of invert sugar very considerably, increased, whilst those of dulcitol and dextrin were slightly, and those of cane sugar and glucose materially, decreased. Before estimating the mannitol in a wine, therefore, the sugars must be removed by fermentation, and the tartrates and malates by precipitation with basic lead acetate. Further, although glycerol has no rotatory power, even in the presence of borax, yet it modifies that of a borax solution of mannitol by withdrawing part of the borax from its combination with the latter; thus the rotatory power of a mannitol-borax solution was reduced from 4° 43′ to 3° 46′ by the addition of a quantity of glycerol, nearly equal in weight to that of the mannitol. A correction must, therefore, be made for the influence of the glycerol.

To prove the identity of the mannitol in wine with that from manna, specimens were prepared in the manner indicated above, with the addition that the products were separated from glycerol by precipitation with alcohol, decolorised with animal charcoal, and crystallised from water. They were in every respect identical with mannitol from manna. JN. W.

Estimation of Sugar by Fehling's Solution. By E. NIHOUL (*Chem. Zeit.*, 1894, **18**, 881—882).—The author's process (Abstr., 1893, ii, 601) has been criticised by Grünhut (this vol., ii, 91), who states that neither simple roasting nor treatment with nitric acid and subsequent ignition is capable of fully converting cuprous oxide into the cupric compound.

The author has made a long series of experiments, which show the incorrectness of Grünhut's statements. L. DE K.

Estimation of Glucose by means of Alkaline Copper Solutions. By F. GAUD (*Compt. rend.*, 1894, **119**, 650—652).—The error in the estimation of glucose by means of alkaline copper solutions arises from secondary reactions (compare this vol., i, 163), and, if not constant, varies regularly with the concentration of the glucose solution. Accurate results can be obtained by (1) always working with glucose solutions of approximately the same strength and with constant volumes of liquid and constant temperatures, or (2) by making a correction for the error. A large number of estimations made by the author show that, with concentrations varying between 0·1 and 10·0 per 100, which are the limits met with in practice, the error y is given as a function of the exact strength x, by the expression $y = -0{\cdot}00004801\,x + 0{\cdot}02876359\,x^2$, or, introducing the experimental result θ,

$$0{\cdot}02876x^2 - 1{\cdot}00004801x + \theta = 0.$$

A third method is to remove the cause of the error, by substituting ammonia for sodium hydroxide. The operation must be conducted in an atmosphere of hydrogen or nitrogen, and the liquid must not be heated above 80°, or too much ammonia will be expelled from the liquid. No filtration is needed, and the completion of the reaction can be determined with great accuracy. A solution of 34·65 grams of copper sulphate in a small quantity of water, diluted to 1 litre with ordinary ammonia, gives good results. The copper can be reoxidised by means of a current of air, and the solution can be used again if a small quantity of concentrated ammonia solution is added (compare this vol., ii, 93). C. H. B.

Analysis of Urine. By A. HEINEBUCH (*Chem. Centr.*, 1894, ii, 115—116; from *Pharm. Centr.*, **35**, 289—290).—Fehling's solution fails to detect sugar when the amount of the latter falls below 0·05 per cent., but Boettger's test (alkaline bismuth solution) still gives a good reaction with solutions containing as little as 0·025 per cent. The most delicate reaction is obtained by the phenylhydrazine test, which detects as little as 0·01 per cent. of diabetic sugar. When using the polariscope, the urine should be decolorised with basic lead acetate, and not with animal charcoal, as this also removes some of the sugar. For the detection of albumin, the author uses the reaction with acetic acid and potassium thiocyanate, in preference to the one with acetic acid and potassium ferrocyanide. Both tests indicate as little as 0·006 per cent. of albumin, whilst the test with succinic acid and potassium ferrocyanide is only obtained with 0·007 per cent., and the nitric acid test with 0·01 per cent. L. DE K.

Influence of Normal or Basic Lead Acetate on Invert Sugar. By A. BORNTRÄGER (*Zeit. angw. Chem.*, 579—582).—The author has found that excess of lead acetate added to a solution of invert sugar does not, on standing, cause a diminution of sugar, but, if the mixture is evaporated for some time, an appreciable destruction of sugar takes place.

Basic lead acetate behaves like the normal salt. L. DE K.

Estimation of Starch by Alcoholic Fermentation. By A. MUNSCHE (*Chem. Centr.*, 1894, ii, 220—221, 300—301; from *Wochschr. Breuerei*, **11**, 795—798, 821—824).—The sample is treated with an aqueous infusion of malt, which, at a temperature of 61—65°, will, in about half an hour, completely dissolve the starch. After cooling, some mineral phosphatic yeast food is added, also some nitrogenous food, in the shape of asparagine. After adding a weighed quantity of yeast, the liquid is put into an ordinary fermentation flask and fermented for 72 hours. Both carbonic anhydride and alcohol are estimated, but an allowance is made for the amount of these substances yielded by the malt extract itself. 51·29 parts of carbonic anhydride or 53·43 parts of alcohol correspond with 100 parts of starch.

L. DE K.

New Process for Estimating Furfuraldehyde and Pentosans. By C. COUNCLER (*Chem. Zeit.*, 1894, **18**, 966—968).—Five grams of the sample to be tested for pentosans is distilled with dilute (12 per cent.) hydrochloric acid until the distillate no longer shows the furfuraldehyde reaction. The distillate is then diluted with the same acid to 250—500 c.c., and an aliquot part, say 20—50 c.c., is put into a stoppered flask and mixed with a not too large excess of phloroglucinol. After thorough shaking, the mixture is left for about 12 hours, the precipitate is collected on a weighed filter (dried at 98°), washed, dried at 98°, and weighed. Its weight, divided by 2·12, represents the weight of furfuraldehyde; if, however, the weight is below 0·1 gram, the factor 1·98 should be used.

The furfuraldehyde, thus found, is then calculated to pentosan, using Tollen's factor. L. DE K.

Estimation of Thiocyanic acid. By J. GONDOIN (*J. Pharm.*, 1894, [5], **30**, 481—484).—As copper is estimated as copper thiocyanate, the author has tried, and successfully, to estimate thiocyanic acid as this salt. The solution to be examined must be perfectly clear, and contain no free nitric acid. If free nitric acid is present, soda or potash must be added until the solution is alkaline, and this then again rendered acid with sulphurous acid. If the solution is alkaline or neutral, it should be made acid with sulphurous acid. About an equal volume of a 2 per cent. aqueous solution of sulphurous anhydride is added, and then a 10 per cent. solution of cupric sulphate, until no further precipitate is formed. The precipitate is white, the liquid green. The mixture is then heated at 80°, until the green colour just changes to blue. If the solution remains green more sulphurous acid must be added, and the whole boiled. The precipitate is collected on a tared filter, washed with hot water, dried at 100°, and weighed. Very accurate results are obtained, and the accuracy is not affected by the presence of mineral salts or cyanides.

L. T. T.

Analysis of Milk. By M. Weibull (*Chem. Zeit.*, 1894, **18**, 926—928).—The author's process for the determination of the specific gravity of sour milk has been adversely criticised by Okulitsch. In reply, the author states that the process gives very satisfactory results if carried out exactly as follows:—The sample is mixed with a known volume—about one-tenth of its bulk—of ammonia, and the whole is well shaken. After about an hour, when the contents have become quite fluid, the liquid is transferred to a graduated cylinder and measured. Its specific gravity is then taken, and after allowing for the specific gravity of the ammonia and the dilution, the specific gravity of the sample is found by a simple calculation.

The fat is estimated by measuring the prepared sample in a pipette, so constructed that it will deliver exactly 7 grams of ammoniacal milk. This is then dropped on to a coil of filter-paper (Adam's process), dried and extracted with anhydrous ether. If moist ether is used, some ammonium lactate gets dissolved. The weight of fat obtained is, of course, corrected for dilution. L. de K.

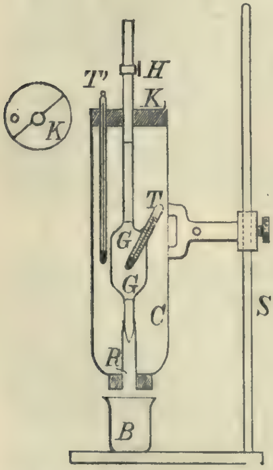
Detection of Margarine in Butter. By Seyda and Woy (*Chem. Zeit.*, 1894, **18**, 906—907).—The authors criticise the three principal processes in use for the detection of margarine in butter.

Köttstorfer's Method.—This process, which gives the saponification number of the sample, is, of course, affected by the natural variation in the composition of butter-fat, but it is almost free from analytical errors, and, therefore, the best process as yet known.

The *Reichert-Meissl Method* is based on the estimation of the volatile fatty acids. This process is liable to several analytical errors, the chief objection being that the whole of the volatile fatty acids is not collected, and it is only by exercising the greatest precautions that something like concordant results can be obtained.

Hehner's Method.—This process is based on the estimation of the insoluble fatty acids, and in the authors' opinion is the most complicated and untrustworthy of the three, and quite unsuited for commercial laboratories. Although the excess of mineral acid is comparatively soon washed out, the soluble fatty acids are only removed with great trouble, often necessitating a washing with 2—3 litres of boiling water. There is also great danger of serious loss by the insoluble fatty acids passing through the filter. L. de K.

Testing Butter for Foreign Fats. By C. Killing (*Zeit. angw. Chem.*, 1894, 643—645).—The lower part of a wide glass cylinder, *C* (see next page), is closed by means of an india-rubber cork, admitting a small tube, *R*. This supports and accurately fits a 50-c.c. pipette, *G*, the lower end of which is drawn out to a point 1 mm. wide, whilst the top is provided with a stop-cock, *H*. *G* is provided with a removable thermometer, *T*, and has also two marks, one just above and another just below the bulb. At a distance of 10 cm. from the former another mark is made. The top of the cylinder is closed by a cork cut in two, one half of which admits the thermometer, *T'*. It is of the greatest importance that these thermometers should be very exact. *S* is a stand with clamps, whilst *B* is simply a beaker.



The apparatus, which is first of all tried with water at 20°, is then used for butter as follows:—The corks and thermometer T' are removed, the pipette is lifted out, and the thermometer, T, is disconnected. The sample to be tested is melted and filtered into the beaker inside a drying oven at 60°. 60 grams of clarified fat is sufficient for an experiment. In the meanwhile $1\frac{1}{2}$ litres of water is heated to 43° in an enamelled saucepan, being stirred with the thermometer T. The butter is now placed in cold water and stirred with T', until the temperature has fallen to 40·5°. At that moment T is at once replaced into the bulb, the butter is drawn up by suction until it reaches the top mark, the greased stop-cock is closed and G connected with R. After placing B under R, the water, which has now cooled down to 42°, is poured down as rapidly as possible into C, only leaving room for the corks. As soon as both thermometers show 40°, the tap is gently opened to allow the oil to run down to the middle mark. The stop-cock is now suddenly fully opened, and the operator, having an accurate chronoscope or watch with a seconds hand at disposal, notices the exact time it takes for the oil to run down to the lower graduation. The experiment must be made three times, and the average result recorded. The viscosity number of an oil is found by dividing the number of seconds which it takes to run through the apparatus at 40° by the number of seconds occupied by water at 20°, and multiplying the result by 100. The viscosity number of eight samples of butter varied from 276·2—281·3, average 278·5, whilst 11 samples of margarine of widely different origin gave figures varying from 313·3—317·4, average 314·7. These results being fairly constant, the author has no hesitation in recommending the taking of the viscosity number as an accurate way of estimating the amount of added solid margarine in commercial butters. If x stands for margarine and v for the viscosity number, the equation will be

$$x = (v - 278{\cdot}5)\,\frac{100}{314{\cdot}7 - 278{\cdot}5}, \quad \text{or} \quad x = 2{\cdot}76\,(v - 278{\cdot}5).$$

L. DE K.

Analysis of Lard. By G. HALPHEN (*J. Pharm.*, 1894, [5], **30**, 241—247).—In the analysis of lard, the presence of vegetable oils is readily detected by the present methods of analysis, but it is difficult to detect adulteration with beef and mutton suet. The authors find the separate determination of the iodine absorption of the separated liquid and solid acids from the lard to give good results. The liquid acids show an iodine absorption three to four times as great as that of the solid acids.

The acids are separated by Lear's method by treating them in carbon bisulphide solution with zinc oxide. The following table gives the results obtained.

Fat.	Iodine absorption.			Soluble zinc salts.		Liquid acids, per cent	Solid acids, per cent.
	By 100 grams of total acids.	By 100 grams of liquid acids.	By 100 grams of solid acids.	Weight.	Colour.		
Pure American lard	63·5	91·95	28·83	64·7	amber	57·14	42·86
,, French ,,	59·0	86·61	32·91	57·83	,,	50·72	49·28
American fat, A...	83·56	117·1	47·58	61·20	orange	53·86	46·14
,, ,, B...	83·56	114·04	48·56	63·06	,,	55·60	44·40
Beef suet (pressed)	17·01	75·60	12·95	7·84	amber	6·80	93·2
Mutton suet......	37·84	80·26	17·52	35·20	,,	31·44	68·56
Cotton oil........	102·36	129·03	49·53	78·15	orange	69·06	30·96

These numbers serve not only to detect adulteration, but to form some idea of its extent and character. L. T. T.

Analysis of Linseed Oil. By F. Filsinger (*Chem. Zeit.*, 1894, **18**, 1005—1006).—The author recommends using the polariscope for the detection of rosin oil in linseed oil. Oil prepared from German or Indian seed is optically quite inactive, whilst rosin oils have a strongly right-handed polarisation.

When making an iodine absorption test, the Hübl solution should be allowed to act for 20 hours. L. de K.

Analysis of Castor Oil. By G. Morpurgo (*Chem. Centr.*, 1894, ii, 179; from *Pharm. Post*, **27**, 245).—The sample of adulterated castor oil is mixed with treble its volume of vaselin oil, and kept at 10—15°. As pure castor oil is nearly insoluble, it will, after some time, form a very distinct bottom layer, which may be measured. If seed oils are adulterated with 40—50 per cent. of castor oil di Vetere's process is recommended. The sample is agitated with half its volume of fuming hydrochloric acid when three layers are formed, the bottom layer consisting of the acid, the middle one of the castor oil more or less coloured, and the top layer containing the seed oil. To prove the identity of the castor oil, advantage may be taken of its solubility in spirits of wine. The author also recommends Draper's test:—A few drops of the oil is oxidised with about 6 drops of nitric acid, and then neutralised with sodium carbonate. If castor oil is present, the mixture emits a strong odour of œnanthylic acid.

L. de K.

Detection of Castor Oil in Copaiba Balsam and Croton Oil. By L. Maupy (*Chem. Centr.*, 1894, i, 929; from *Rev. intern. falsific*, **7**, 114).—The formation of sebacic acid and caprylic alcohol when castor oil is heated with sodium hydroxide is employed for the detection of the latter. 10 grams of the balsam, or 5 grams of croton oil, is heated in a silver basin with 10 grams of sodium hydroxide; white vapours are evolved during the whole operation, and, in presence of castor oil, the odour of caprylic alcohol is very conspicuous. When, by stirring, a homogeneous fluid paste has been obtained, 50 c.c. of water is added, and the solution filtered hot through a wetted double filter in a hot-water jacket. Sebacic acid is then thrown down from the filtrate on the addition of a mineral acid. M. J. S.

Application of Gas Analysis to Cheese-making. By M. Schaffer (*Staz. Sper. Agrar.*, 1894, **26**, 32—47; from *Landw. Jahrb. d. Schweiz.* 1893, **7**, 72).—The presence of micro-organisms being an important point in cheese-making, and their isolation and identification a process too difficult and laborious for general use, the author has devised a method by means of which the presence of the particular ferment which causes swelling in cheese can be detected, and its relative amount ascertained. This is done by keeping the milk at a temperature of 38°, and collecting and measuring the gas evolved in a given time. The apparatus consists of a cylindrical vessel (100 c.c. capacity) connected, by means of a narrow tube bent four times, with the lower end of an upright graduated tube. This has at its lower end a second (outlet) tube, which is bent upwards a little and terminates in a bulb. The upper end of the measuring tube is provided with a tap. When used, the apparatus is first sterilised; the lower vessel is then filled with milk (100 c.c.), the upper vessel with an antiseptic liquid coloured with magenta and acidified with sulphuric acid (0·5 per cent.). The two portions of the apparatus are connected and placed in a Walther fermentation apparatus kept at 38°. The gas, if produced, rises into the measuring tube, the water so displaced flowing into the bulb.

A number of experiments were made with milk, rennet, and sterilised milk diluted with water from various sources; and the results are given in tables. One sample of milk, infected with *Guillebau a* (a bacillus known to produce the swelling of cheese), gave 82 c.c. of gas, or 82 per cent. by volume, after 24 hours. Milk which produces 10 per cent. of gas in 12 hours would doubtless cause the cheese to swell. All the samples of rennet gave more or less gas, showing how important it is that rennet should be prepared with more care than is usual. The samples of water used in diluting the milk of the third series of experiments were analysed. There seemed to be no very definite relation between their chemical composition and the amount of gas they caused to be given off by the milk. Most of them produced gas (compare E. v. Freudenreich, *J. Board of Agric.*, 1894, **1**, 68). N. H. J. M.

General and Physical Chemistry.

Superposing of the Optical Effects of Different Asymmetric Carbon Atoms in the same Active Molecule. By PHILLIPE A. GUYE and M. GAUTIER (*Compt. rend.*, 1894, **119**, 740—743).—The authors advance the two following theories, with reference to the effects due to different asymmetric carbon atoms in the same active molecule.

1. In any molecule containing several asymmetric carbon atoms, each one behaves as though the rest of the molecule was inactive.

2. The optical effects of the different asymmetric carbon atoms may be summed algebraically.

From these principles, it follows that the rotatory power of a substance containing several asymmetric carbon atoms may be obtained by ascertaining the effect due to each atom, as if the rest of the molecule was inactive, and then taking the sum of the several effects.

This the authors have done for the amylic oxide $(CHMeEt\cdot CH_2)_2O$, the results actually obtained being in accordance with the theory.

H. C.

Optical Rotation of Amyl Derivatives. By PAUL WALDEN (*Zeit. physikal Chem.*, 1894, **15**, 638—655).—In order to test the validity of

Compounds.	m_1.	Spec. rot.	Mol. rot.
Amylacetic acid, $Ay\cdot CH_2\cdot COOH$	73·0	+8·53	11·08
Amylic acetate, $CH_3\cdot COOAy$	73·0	2·50	3·25
Amylic bromide, AyBr	94·0	3·50	5·29
Amylpiperidine, $C_5NH_{10}Ay$	98·0	7·94	12·31
Ethylic amylacetate, $Ay\cdot CH_2\cdot COOEt$	101·0	6·56	10·37
Amylic butyrate, $C_3H_7\cdot COOAy$	101·0	2·97	4·69
Amylic isobutyrate, $CHMe_2\cdot COOAy$	101·0	2·83	4·47
Amylic chloracetate, $CH_2Cl\cdot COOAy$	107·5	3·16	5·20
Amylmalonic acid, $Ay\cdot CH(COOH)_2$	117·0	5·25	9·13
Ethylic amylacetoacetate, $COMe\cdot CHAy\cdot COOEt$	143·0	12·14	24·28
Amylic iodide, AyI	141·0	4·55	9·00
Amylic bromobutyrate, $CHEtBr\cdot COOAy$	180·0	2·27	5·38
Amylic isobromobutyrate, $CBrMe_2\cdot COOAy$	180·0	2·53	6·00
Diethylic amylmalonate, $Ay\cdot CH(COOEt)_2$	173·0	10·14	23·32
Diethylic paranitrobenzylamylmalonate, $NO_2\cdot C_6H_4\cdot CH_2\cdot CAy(COOEt)_2$	308·0	1·25	4·56
Diamylacetic acid, $CHAy_2\cdot COOH$	143·0	18·27	36·54
Amylic amylacetate, $Ay\cdot CH_2\cdot COOAy$	143·0	7·01	14·02
Ethylic diamylacetate, $CHAy_2\cdot COOEt$	171·0	17·99	41·01
Diamylic oxalate, $C_2O_4Ay_2$	173·0	4·93	11·35
Diamylic fumarate, $C_2H_2(COOAy)_2$	199·0	5·69	14·56
Diamylic maleate, $C_2H_2(COOAy)_2$	199·0	4·35	11·13
Ethylic diamylacetoacetate, $COMe\cdot CAy_2\cdot COOEt$	213·0	±0·00	0·00
Diamylic chlorofumarate, $COOAy\cdot CH{:}CCl\cdot COOAy$	233·5	+5·74	16·67
Diamylic chloromaleate, $COOAy\cdot CH{:}CCl\cdot COOAy$	233·5	4·60	13·36
Diethylic diamylmalonate, $CAy_2(COOEt)_2$	243·0	5·82	17·46
Diamylic phthalate, $C_6H_4(COOAy)_2$	249·0	3·88	11·87
Amylic diamylacetate, $CHAy_2\cdot COOAy$	213·0	13·96	37·10

Guye's hypothesis, the author determined the rotation of a large number of compounds obtained from active amylic alcohol. The alcohol employed for the purpose had the specific rotation $[\alpha]_D = -4\cdot78$. The weights of the groups in combination with the asymmetric carbon are respectively 1, 15, 29, and m_1, the value of the last variable being given in the third column of the accompanying table which embodies the results of the researches, Ay representing the active amyl radical $CHMeEt\cdot CH_2$.

From these, the author concludes that a constant increase in the weight m_1 may correspond with a decrease as well as an increase in the mol. rotation; that the rotation is largely dependent on the nature of the combined groups; metameric compounds possessing different rotations, and the same obtaining for stereoisomerides. Of isomeric compounds, that one has the greater rotation in which the oxygen aggregate is the farther removed from the asymmetric carbon atom; the presence of a second active radical may correspond with either an increase or decrease in the rotation. L. M. J.

Action of the Cathode Discharge on some Salts. By Eugen Goldstein (*Ann. Phys. Chem.*, 1894, [2], **54**, 371—380).—The cathode discharge causes phosphorescence in many substances, and the author finds that several of these at the same time undergo remarkable changes. Thus lithium chloride, the phosphorescence of which is of an intense bright blue, changes in a short time from white to a heliotrope or dark violet colour, the phosphorescence at the same time becoming fainter. If the tube containing the salt is vacuous or filled with dry air, the coloration is permanent, but when the tube is opened and ordinary air admitted, the salt again becomes colourless. If the coloured salt is gently heated, the dark violet changes to a brown, but when strongly heated, the salt becomes colourless. The chlorides of sodium and potassium give rise to similar phenomena, as do also potassium iodide and carbonate, lithium bromide and iodide, sodium bromide and rubidium iodide. The author considers that the changes are due to a physical modification and not to chemical change in the substances in question. H. C.

Condensation of Electrolytic Gas by Porous Substances, especially by Metals of the Platinum Group. By Louis P. Cailletet and Emmanuel Collardeau (*Compt. rend.*, 1894, **119**, 830—834; and by Marcellin Berthelot, *ibid.*, 834).—Spongy platinum was enclosed in two small silk bags, together with a platinum wire to serve as a conductor, and immersed in dilute sulphuric acid (1 : 10), one bag forming the anode and the other the cathode. An electric current was allowed to pass until the platinum was presumably saturated with the two gases, and the two bags were then placed in electrical communication so as to form a gas battery similar to that of Grove. Under these conditions, a much more powerful and persistent current is obtained than with the same weight of platinum in the ordinary metallic condition, and the duration of the current is greatly increased under pressure.

Under atmospheric pressure, the discharge lasts only about 10 seconds and the E.M.F. falls continuously from 1·8 volts to zero.

Under gradually increasing pressure, the manner of discharge gradually alters and three periods are recognisable. There is first a period of very rapid fall in the intensity of the current, which afterwards rises slightly; this is followed by a period of constant intensity, the intensity slightly increasing with the pressure, and the E.M.F. being about 1 volt; finally there is a period of fall less rapid than the first. The capacity of the accumulator thus formed by the spongy platinum is 56 ampère-hours per kilo. of metal under a pressure of 580 atmos., and the intensity of the current may easily reach 100 ampères per kilo. In order to obtain the best results, about three times as much platinum should be used for the negative pole as for the positive. The yield of the accumulator is as high as 95 or even 98 per cent. provided that the charge is not pushed to its limit, and that the discharge begins immediately after charging.

Iridium behaves like platinum; ruthenium is slightly attacked at the positive pole, but will also form an accumulator with a capacity that increases with the pressure, but with an E.M.F. that is not constant but decreases continuously from 1·6 volts to zero, whatever the pressure.

Palladium in the metallic form constitutes an accumulator of very feeble capacity, owing to the rapidity with which it is saturated by oxygen, but in a spongy condition, it gives results much better than those obtained with any other metal of the platinum group, and even under atmospheric pressure is equal to platinum under a pressure of 20 to 30 atmos. As the pressure increases, the phenomena are similar to those observed with platinum, but the capacity of the accumulator is three or four times as great, and under a pressure of 600 atmos. may reach 176 ampère-hours per kilo.

Gold precipitated by sulphurous acid behaves like the platinum metals, but the capacity is lower and the intensity of the current varies somewhat differently.

Silver, tin, nickel, cobalt, and carbon, undergo change at the positive pole, and although there is some accumulation of electrical energy, it is not affected by pressure and seems to be due to chemical changes.

Berthelot points out that platinum, palladium, and analogous metals form definite compounds with oxygen, and especially with hydrogen, at the ordinary temperature, their formation being influenced by pressure. C. H. B.

Limits of Electrolysis. By MARCELLIN BERTHELOT (*Ann. Chim. Phys.*, 1894, [7], **3**, 138—144).—The author has formerly shown by experiment that in the electrolysis of an alkali salt, of which neither the acid nor base is oxidised or reduced during the operation, the minimum E.M.F. necessary for electrolysis is the sum of two equivalent quantities, the one being the heat absorbed in the separation of the acid and the base in dilute solution, the other the heat of decomposition into oxygen and hydrogen of the water holding the substance in solution. In the case, for instance, of potassium sulphate in dilute solution, the sum of the two quantities of heat is

$$15·7 + 34·5 = 50·2 \text{ Cal.},$$

when 1 gram of hydrogen is liberated. This is equivalent to 2·20 volts, a number which Le Blanc has obtained by direct observation. Other results are quoted in support of the above law, which the author maintains as an empirical law, independent of any hypothesis regarding the condition of the dissolved salts in solution. H. C.

Thermoelectric Phenomena between Two Electrolytes. By Henri Bagard (*Ann. Chim. Phys.*, 1894, [7], **3**, 83—138).—In continuation of his researches (Abstr., 1892, 1037, and 1893, ii, 202), the author has determined the thermoelectric E.M.F. in the cases of a number of couples consisting of two electrolytes. The E.M.F. is in all cases, as with the metals, a function of the second degree of the temperature, and very frequently the existence of a neutral point was observed somewhere between 0° and 75°, the limits of temperature of the experiments. In the case of two solutions of the same salt of different degrees of concentrations, the current always travels across the heated junction from the dilute to the concentrated solution. Becquerel's law of intermediate substances, and the law of intermediate temperatures are found to hold good. There is a simultaneous inversion of the thermoelectric E.M.F. and of the Peltier effect at the point of contact of the two electrolytes, and an electrical transference of heat in these liquids. H. C.

Thermoelectric Properties of Platinoid and Manganine. By Benjamin O. Peirce (*Amer. J. Sci.*, 1894, [3], **48**, 302—306).—The author has had occasion to determine the thermoelectric relations of copper to such platinoid and manganine as are to be obtained in the market. The nature of the results will be seen from the following table. The current passes across the hot junction from the first named metal to the second; the E.M.F. is measured in microvolts.

	E.M.F.	
Temperatures of the junctions.	Copper *vs.* manganine.	Platinoid *vs.* copper.
0° and 10°	4·3	189
0 ,, 20	9·2	379
0 ,, 30	14·1	572
0 ,, 40	19·6	769
0 ,, 50	25·7	971
0 ,, 60	32·6	1179
0 ,, 70	40·2	1391
0 ,, 80	48·1	1609
0 ,, 90	56·4	1834
0 ,, 100	64·9	2063

The results vary with the thickness of the wires used and the annealing of the metals, but the E.M.F. of no one of the manganine-copper combinations experimented on was greater than about one-seventh that of the weakest of the platinoid-copper combinations under similar circumstances. Hard drawn manganine wire can be used with advantage as a slide wire, since accidental heating does not alter its resistance appreciably, and the thermoelectric effects at the junctions of the slider would be insensible. H. C.

Influence of Magnetism on Chemical Action. By F. A. Wolff, jun. (*Amer. Chem. J.*, 1895, **17**, 122—138).—In 1881, Remsen noticed that when copper is deposited from a solution of copper sulphate on a plate of iron placed on the poles of a magnet, it is arranged in ridges round the poles which are at right angles to the lines of force and consequently coincident with the lines marking the equipotential surfaces. The outlines of the poles of the magnet are always sharply defined on the plate, as along these lines a portion of the iron of greater or less width is left unacted on. The author has investigated these phenomena, and his results and conclusions are contained in this paper. The absence of deposit over the outlines of the pole is not due to any direct influence of magnetism on chemical action, but to the accumulation of the iron salts formed in the reaction about those parts, and to the electric currents arising therefrom. The fact that the deposit is thickest immediately adjoining the protected region also finds its explanation in the electrolysis accompanying these currents. The deposition in ridges is not due to any direct influence of magnetism on chemical action, and is not directly due to the voltaic currents in the liquid. Copper is deposited in ridges on both magnetic and non-magnetic metal when a solution of copper sulphate is allowed to flow over them and the ridges are arranged along the lines of flow. The deposition in ridges when copper is deposited on iron in a magnetic field may be due to similar action. H. C.

Formula of van der Waals: $\log p_c - \log p = f\,\mathrm{T}c/\mathrm{T} - f$. By Phillipe A. Guye (*Chem. Centr.*, 1894, ii, 8; from *Arch. Sci. Phys., Genève*, [3], **31**, 463—480).—Van der Waals expresses the relationship of the vapour pressure to the temperature by the formula $\log p_c - \log p = f\,\mathrm{T}c/\mathrm{T} - f$, where T$c$ is the absolute critical temperature, p_c the critical pressure, p the vapour pressure at any other temperature T, and f a constant. The numerous vapour pressure determinations that have been made in recent times have enabled the author to submit this relationship to a new and thorough examination. It is found that those liquids in which, according to the investigations of Ramsay and Shields, complex molecules are present, must be considered apart from those in which only simple molecules occur. Substances of the latter order give values for the constant f which vary but slightly from a certain mean value. Thus, for benzene, the values lie between 2·827 and 2·976, and for carbon tetrachloride from 2·753 to 3·022. The mean value for the constant with liquids containing simple molecules is 3·06. Liquids which approximate to this are benzene, chloroform, carbon and tin tetrachlorides; ether, fluorobenzene, methylic, ethylic, and propylic formates, acetates and propionates; methylic butyrate and isobutyrate. Variations of the values calculated for f from the mean may perhaps be referred to inaccuracies in the data for the critical constants.

With liquids, the molecules of which are probably polymerised, the value obtained for f no longer approximates to a constant mean value, but is found to be continually decreasing with rising temperature. Thus, ethylic alcohol gives the value 4·024 at 0°, and

3·576 at 230°. The values of f for these liquids are greater than 3·07. The smallest values are methylic alcohol, 3·557; ethylic alcohol, 3·576; propylic alcohol, 3·494; acetic acid, 3·385 (compare this vol., ii, p. 99).

H. C.

Law of Corresponding Boiling Points. By ULRICH DÜHRING (*Ber.*, 1895, **28**, 366—367).—The author proposes soon to reply at length to the criticism of his law which has been published recently (this vol., ii, 70).

A. H.

Mercuric Nitrates. By RAOUL VARET (*Compt. rend.*, 1894, **119**, 797—799).—Determinations of the heat of dissolution of mercuric nitrate in nitric acid give the following results.

$Hg(NO_3)_2,\frac{1}{2}H_2O$ sol. + $4HNO_3$ (1 mol. = 1 litre) at 16° .... absorbs −0·71 Cal.

$2[Hg(NO_3)_2,\frac{1}{2}H_2O]$ sol. + $4HNO_3$ (1 mol. = 1 litre) at 16° .... „ −1·42 „

From the action of hydrochloric acid on mercuric nitrate and of nitric acid on mercuric chloride, of hydrocyanic acid on mercuric nitrate and nitric acid on mercuric cyanide, of mercuric nitrate on sodium chloride, and sodium nitrate on mercuric chloride, it follows that

HgO ppt. + $2HNO_3$ dil. = $Hg(NO_3)_2,\frac{1}{2}H_2O$ sol. + H_2O liq. .... develops + 7·36 Cal.

Hg liq. + N_2 gas + O_6 gas + $\frac{1}{2}H_2O$ liq. = $Hg(NO_3)_2,\frac{1}{2}H_2O$ sol. .... „ +58·36 „

Basic Mercuric Nitrate.—Heat of dissolution in dilute nitric acid + 3·8 Cal. Methods similar to those employed in the case of normal nitrate show that

3HgO ppt. + $2HNO_3$ dil. = $3HgO,N_2O_5,H_2O$ liq. .... develops +15·45 Cal.

$Hg(NO_3)_2,\frac{1}{2}H_2O$, sol. + 2HgO + $\frac{1}{2}H_2O$ liq. = $3HgO,N_2O_5,H_2O$ sol. .... „ + 8·09 „

The action of a large quantity of water on normal mercuric nitrate only very partially converts it into the basic salt; $Hg(NO_3)_2,\frac{1}{2}H_2O$ sol. + H_2O, 10 litres = $\frac{13}{16}$ $Hg(NO_3)_2$ diss. + $\frac{2}{16}$ HNO_3 diss. + $\frac{13}{16}$ $(3HgO,N_2O_5,H_2O)$ sol. absorbs − 1·2 Cal.; complete conversion into basic nitrate would absorb − 2·21 Cal., and the dissolution of the basic nitrate in excess of acid would develop 1·26 Cal. The least endothermic reaction corresponds with the formation of a solution containing free nitric acid and saturated with the basic nitrate.

Nitric acid is practically completely displaced from its combination with mercury by hydrocyanic and hydrochloric acids (compare this vol., ii, 103).

C. H. B.

Determination of Molecular Weights. I. By ERNST BECKMANN (*Zeit. physikal. Chem.*, 1894, **15**, 656—680).—The author gives an account and criticism of the various forms of apparatus employed by himself and other observers in the determination of molecular weights by the boiling point method. The boiling tube is first described and compared with those of Raoult, Lespieau and Sakurai; various forms of jacketing vessels, usually of porcelain, are described as well as the condensers and burners generally employed. The method of inserting the substance into the tube is explained and some details in connection with the use of the Beckmann thermometer are given, a table of the values of one scale division at different temperatures being also added. The effects of alterations in the atmospheric pressure are shortly discussed, and the paper, which is illustrated by numerous woodcuts, concludes with a short claim for priority in the employment of certain of the forms of instruments described. L. M. J.

Freezing Points of Mixtures of Alcohol and Water. By Raoul Pictet (*Compt. rend.*, 1894, **119**, 678—682).—The author's results of the determination of the freezing points of mixtures of ethylic alcohol and water are contained in the following table.

Hydrates.	Sp. gr.	Per cent. alcohol.	Freezing point.
$C_2H_6O + H_2O$	0·8671	71·9	−51·3°
,, $2H_2O$	0·9047	56·1	−41·0
,, $3H_2O$	0·9270	46·3	−33·9
,, $4H_2O$	0·9417	39·0	−28·7
,, $5H_2O$	0·9512	33·8	−23·6
,, $6H_2O$	0·9578	29·9	−18·9
,, $7H_2O$	0·9627	26·7	−16·0
,, $8H_2O$	0·9662	24·2	−14·0
,, $9H_2O$	0·9689	22·1	−12·2
,, $10H_2O$	0·9712	20·3	−10·6
,, $11H_2O$	0·9732	18·8	− 9·4
,, $12H_2O$	0·9747	17·5	− 8·7
,, $13H_2O$	0·9761	16·4	− 7·5
,, $16H_2O$	0·9793	13·8	− 6·1
,, $20H_2O$	0·9824	11·3	− 5·0
,, $35H_2O$	0·9870	6·8	− 3·0
,, $50H_2O$	0·9916	4·8	− 2·0
,, $100H_2O$	0·9962	2·5	− 1·0

H. C.

Freezing Point of Dilute Solutions. By Walther Nernst and Richard Abegg (*Zeit. physikal. Chem.*, 1894, **15**, 681—693).—If the solutions could be adiabatically enclosed, the temperature would approximate towards the true freezing point, T_0, of the solution, and the rate of change of temperature might be considered as given by the equation $dt = K(T_0 - t)dz$ (z = time). Owing, however, to exchange of heat with the surrounding objects, the temperature tends towards a limit t_0, and the course of temperature change would be represented by $dt = k(t_0 - t)dz$. By combining these two equations, we obtain $dt = [K(T_0 - t) + k(t_0 - t)]dz$, and hence, by equating to zero, the final temperature $t_1 = T_0 - k/K(t' - t_0)$. This is the temperature observed in the freezing point observations, and differs from T_0 by an amount dependent on $t_0 - T_0$ and the magnitude of K.

Experiments were then undertaken on the freezing points of solutions of sodium chloride, ethylic alcohol, and cane sugar, previous experiments having been made in each case to obtain the values of k/K and t_0. In the case of sodium chloride solutions, the correction is so small as to be negligible, and the results of the author, of Jones, and of Loomis, show excellent agreement. In the case of cane sugar, however, the correction is no longer negligible, reaching, in some cases, 0·006°. The results, uncorrected and corrected, are contained in the table.

t.	t (corr.).	m.	t/m.	t/m (corr.).
0·0277	0·0337	0·0178	1·55	1·88
0·0612	0·0634	0·0353	1·73	1·79
0·1222	0·1247	0·0688	1·78	1·81
0·2410	0·2450	0·1305	1·85	1·88

The values for t/m so obtained are constant to within experimental limits. To further test these views, a jacket at $-2·7°$ was used, whereby $t_0 < t_1$; the value for $t(\text{corr.})/m$ so obtained is 1·86 The high results of Arrhenius, Raoult, and Jones are, in all probability, due to the use of a jacket at a much lower temperature than the freezing point of the solution. L. M. J.

Cryoscopic Researches on Alkali Aluminates and Borates. By ARTHUR A. NOYES and W. R. WHITNEY (*Zeit. physikal. Chem.*, 1894, **15**, 694—698).—The authors first determined the lowering of the freezing point caused by dissolving aluminium in alkali solutions, employing for the purpose the ordinary Beckmann apparatus. The freezing point of the alkali is not noticeably altered, hence the composition of the aluminate must be represented by $\mathrm{MAlO_2}$, the aluminium being trivalent. For the examination of borates, alkali solutions were prepared and boric acid added. In the more dilute solution, no lowering occurred until the boric acid and alkali were present in molecular ratio; a slight increase being observed in the stronger solutions. The borates formed must hence correspond with the formula $\mathrm{MBO_2}$ or $\mathrm{MH_2BO_3}$. Addition of a second molecule of boric acid caused a diminution of the lowering to about three-fourths the original value, further addition producing no further effect. This, the author considers, is due to the formation of complex salts containing 2 potash and 4 boric acid molecules, which dissociate into 2 potassium and 1 complex acid ion, that is, $\mathrm{M_2B_4O_7}$, whilst other boric acid molecules attach themselves to the acid radicle and consequently produce no effect on the freezing point.

L. M. J.

Solubility of Solid Non-electrolytes in Mixtures of Ethylic Alcohol and Water. By ARNOLD F. HOLLEMAN and A. C. ANTUSCH (*Rec. Trav. Chim.*, 1894, **13**, 277—306).—Bodländer (Abstr., 1891, 794), from a study of the solubility of substances in mixtures of water and alcohol, concludes that $\mathrm{W}/\sqrt[3]{\mathrm{S}} = \text{const.}$, where W is the quantity of alcohol contained in a given volume of the solution, and S the quantity of the dissolved substance in the same volume. The authors have examined the solubilities of the following substances in mixtures in all proportions of alcohol and water:—Paracetotoluidide, α-acetonaphthalide, phenylthiocarbamide, benzoylphenylhydrazine, triphenylguanidine, acetanilide, benzamide, trinitrobenzene, and alanine. They find that Bodländer's formula does not hold for their results. In all cases, except that of alanine, which is more soluble in water than in alcohol, the compounds dissolve to a greater extent in alcohol than in water. On the addition of water to the alcohol, the solubility usually at first undergoes a marked increase, a maximum is reached, and then the solubility decreases. In a few cases, the preliminary increase was not observed.

The authors consider that their results are not in harmony with Nernst's views of the mechanism of solution, and certainly not in agreement with the assumption that no attraction exists between the solvent and the dissolving substance. Although they do not regard the existence of hydrates of alcohol as being definitely proved, the assumption that such hydrates are present would afford a logical explanation of their results. Other possible assumptions are that the dissolved substance forms condensed molecules in the mixtures of alcohol and water, or that the dissolved substance combines either with the alcohol or with the water. H. C.

Ternary Mixtures. By Wilder D. Bancroft (*Proc. Amer. Acad. Art. Sci.*, 1894, **30**, 324—368).—Since, in the application of the laws of gases to solutions, no difference has been observed between a solid and a liquid when dissolved, it appears probable that in all cases where a third substance, *B*, is added to a solution of *A* in *S*, the solubility of *A* undergoes a change. This variation may be large or small, positive or negative, depending on the nature of the three substances *A*, *B*, and *S*. The author proposes the word "solute" for the substance dissolved in the liquid, and "consolute" liquids instead of infinitely miscible liquids.

The simplest case of a three-liquid system is when there are two practically non-miscible liquids, and a third with which each of the others is miscible in all proportions. Let *A* and *B* be two non-miscible liquids, *S* the common solvent with which *A* and *B* are miscible in all proportions when taken singly, and let the amount of *S* remain constant, so that we are considering the amounts of *A* and *B*, namely *x* and *y*, which will dissolve simultaneously in a fixed amount of *S*. This, being a case of equilibrium, must come under the general equation of equilibrium,

$$\frac{\partial F(x, y)}{\partial x}\, dx + \frac{\partial F(x, y)}{\partial y}\, dy = 0,$$

where *dx* and *dy* denote the changes in the concentrations of *A* and *B* respectively. If it is assumed in accordance with the Mass law that the change in solubility is a function of the amounts of *A* and *B* already present,

$$\frac{\alpha dx}{x} + \frac{\beta dy}{y} = 0,$$

or

$$\alpha d \log x + \beta \log y = 0,$$

where α and β are proportionality factors. If these are constants, and $\alpha/\beta = n$, we get, after integration and clearing of logarithms,

$$x^n y = \text{const.}$$

This is the expression representing the saturated solutions of two immiscible liquids in a constant quantity of a consolute liquid, and has been tested by the author and found to hold in cases where the pairs of immiscible liquids were chloroform and water, and benzene and water, and the consolute liquids methylic and ethylic alcohols and acetone, with the one exception of the chloroform-water-acetone series, where the disturbing effect is probably due to chloroform and acetone in presence of each other. It is found, however, that in most cases the concentrations cannot be given by one curve, but involve two, so that for one set of concentrations we have the relation $x^{n_1}y = C_1$, and for the other set $x^{n_2}y = C_2$. The two sets of saturated solutions correspond with different conditions. Thus, in the chloroform-water-alcohol series, the one set of solutions is saturated in respect to chloroform and not in respect to water; the other set is saturated in respect to water and not in respect to chloroform.

Analogous reasoning to the above is applied in the case in which we have two partially miscible liquids, and a third miscible in all proportions with each of the others. If s_1 is the solubility of the first in the second, and s_2 the solubility of the second in the first,

$$(x - s_2y)^n(y - s_1x) = \text{const.}$$

This relationship is tested in cases in which the partially miscible liquids are ether and water, and ethylic acetate and water, and the consolute liquids as before methylic and ethylic alcohols and acetone. When the liquids A and B are partially miscible, we have four curves instead of two. These refer to four distinct sets of equilibrium, there being the following four series of saturated solutions.

1. The solution is saturated in respect to B. Excess of A produces no precipitate.

2. The solution is saturated in respect to B. Excess of A or B produces a precipitate of B.

3. The solution is saturated in respect to A. Excess of A or B produces a precipitate of A.

4. The solution is saturated in respect to A. Excess of B produces no precipitate.

In addition to his own experiments, the author quotes those of others, more particularly of Pfeiffer (Abstr., 1892, 1046), in support of the above deductions. H. C.

Equilibrium between Liquid and Solid Phases. By H. W. BAKHUIS ROOZEBOOM and FRANS A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1894, **15**, 588—638; compare Abstr., 1894, ii, 9).—The system considered is that of water, hydrochloric acid, and ferric chloride. The complete solubility isothermals for $Fe_2Cl_6 + 12H_2O$, $+ 7H_2O$, $+ 5H_2O$, $+ 4H_2O$, and anhydrous, were determined for varying hydrochloric acid contents. The curves are mapped against two axes representing the number of molecules of the acid and of ferric chloride per 100 mols. of water, and, as expected, are concave to the former axis. The fields of equilibrium of the solution in presence of the phases $Fe_2Cl_6 + 12H_2O$ are hence determined, and from their intersection the line of equilibrium of the solution in the presence of two phases, and also the transition temperature from the state $Fe_2Cl_6 + 12H_2O$ to $Fe_2Cl_6 + 7H_2O$, &c., at varying percentage of hydrogen chloride. One ternary compound had been previously known, $Fe_2Cl_6,2HCl,4H_2O$. The author obtains two more. The first, represented by $Fe_2Cl_6,2HCl,8H_2O$, is obtained as greenish crystals melting at −3°; the second, $Fe_2Cl_6,2HCl,12H_2O$, in the form of yellow crystals melting at −6°. The solubility isothermals of these were mapped, and are the first examples of the complete realisation of such curves, being, as theoretically expected, closed curves. From their intersection with the isothermals previously obtained, the equilibrium conditions of the ternary phases, and of the combination of ternary and binary, are obtained. The effects of pressure are considered, and numerous experiments are recorded on the transition temperatures of the different compounds.

L. M. J.

Influence of the Substitution of Halogens in Acids on the Rate of Etherification. By D. M. Lichty (*Amer. Chem. J.*, 1895, **17**, 27—31).—The author has compared the etherification values of acetic, mono-, di-, and tri-chloracetic and monobromoacetic acids at 154°. The values were determined at the end of 1, 2, 4, 6, 8, 10, 12, and 54 hours, No satisfactory results were obtained with trichloracetic acid as it underwent secondary reactions, with evolution of gas which caused explosion of the tubes. One successful determination only was obtained, and even with that it is not improbable that the hydrogen chloride liberated influenced the result and made it untrustworthy. The initial rate of etherification increased with the addition of the halogen, and the limit with the mono- and di-chlor- and monobromacetic acids was reached within half an hour.

	Initial rate.	Limit of etherification.
Acetic acid	46·95 per cent.	66·57 per cent.
Monochloracetic acid ..	67·01 ,,	66·62 ,,
Dichloracetic ,, ..	70·16 ,,	70·65 ,,
Trichloracetic ,, ..	—	93—94(?) ,,
Monobromacetic ,, ..	65·87 ,,	65·87 ,,

With monobromacetic acid, the amount of etherification diminished steadily after the first half hour, and was 43·46 per cent. at the end of eight hours. With monochloracetic acid there was a similar reduction after 12 hours, reaching 46·93 per cent. after 54 hours. These results were undoubtedly due to secondary decomposition, but the character of the latter has not been yet ascertained.

L. T. T.

Effect of Hydrolysis on Reaction Velocities. By Frederick L. Kortright (*Amer. Chem. J.*, 1895, **17**, 116—122).—The term hydrolysis is employed to denote the decomposition of a salt in aqueous solution into a base and an acid by the action of the water. When any substance taking part in a reaction is hydrolysed, the total amount of the substance used cannot be taken as its *active* *mass;* only the non-hydrolysed portion can be so considered. This is the case in the reaction studied by Kahlenberg (Abstr., 1894, ii, 346) between ferric chloride and stannous chloride. He has calculated his results on the assumption that the active mass of the reacting substances is the total amount taken, whilst in reality, since ferric chloride and stannous chloride are strongly hydrolysed, the active mass is much less.

The formula applying to this case, $\frac{dx}{dt} = c(a - x)^2$, on integration, yields

$$x/t(a - x) = ac = \text{const.}$$

Since tin and iron are nearly equally strong bases, we may assume that they are equally affected by the water, and since the experiments were carried out, using molecular proportions of each salt, we may assume that the relation continues molecular, and by plotting $x = \phi(t)$ we can select a point where the curve becomes nearly parallel to the t axis, and $(a - x) = h$ is approximately the amount of hydrolysed substance at that time. Assuming that the hydrolysis is constant throughout the experiment, the active mass at the beginning of the experiment becomes $(a - h) = a'$, and substituting this value for the initial active mass

$$x/t(a' - x) = a'c = \text{const.}$$

The author shows that $a'c$ calculated by this means is more nearly constant than ac, the variations being such as would be produced by experimental error. H. C.

Isomorphism. By JAN W. RETGERS (*Zeit. physikal. Chem.*, 1894, **15**, 529—587; compare Abstr., 1891, 146, 1151; 1892, 1048; 1893, ii, 193; 1894, ii, 85, 348).—The author in this communication considers the question whether isomorphous compounds can unite chemically, and regards the negative as the true answer. A list is given of the recorded exceptions, namely, double salts of isomorphous components, 15 in number, chiefly potassium-ammonium, sodium-lithium, sodium-silver, and calcium-barium compounds. These compounds are considered separately, and in every case, except that of barytocalcite, evidence is adduced to prove that the supposed double salt is merely a special case of an isomorphous mixture. The case for barytocalcite is not so clear, the evidence being conflicting and insufficient, and the author considers it requires further research. Experiments are then recorded, undertaken to see whether any double salts are obtainable amongst the vitriol series, solutions of two salts being mixed in different proportions, and the crystals obtained analysed. These experiments include observations on mixtures of the sulphates of iron and cobalt, zinc and magnesium, magnesium and nickel, iron and magnesium, iron and zinc, iron and copper, zinc and copper, and magnesium and copper. In no case is there any indication of the formation of a double compound, the composition of the mixed crystals varying continuously between the end limits. The paper concludes with a controversial reply to the points raised by Rinne (*Zeit. physikal. Chem.*, **14**, 522).

L. M. J.

Certain Regularities in the Weights of Drops of Molten Metals. By Konstantin Thaddéeff (*Ber.*, 1895, **28**, 195—202).—If the end of a rod of metal is melted with a Bunsen burner or in the blow-pipe, and the falling drops collected and weighed, they will be found in the case of any one metal to have approximately the same weight. In the case of different metals, the weight of one drop multiplied by the atomic weight of the metal is also nearly the same in many cases. The following table of results may be quoted, the first set of experiments being made with the middle portion and the second set with the upper portion of one and the same rod of 7 mm. diameter in each case.

	Middle portion.			Upper portion.		
	No. of drops.	Weight of 1 drop.	Wt. of drop × at. wt.	No. of drops.	Weight of 1 drop.	Wt. of drop × at. wt.
Zinc	5	2·2071	143·4	5	2·1065	136·9
Lead	20	0·7664	158·6	23	0·8029	166·2
Tin	9	1·3172	155·4	10	1·1954	141·0
Bismuth	17	0·7266	152·6	30	0·5402	113·4
Cadmium	10	1·2378	138·6	9	1·2702	142·2
Antimony	12	0·5112	61·3	20	0·4954	59·4

Probably the product should be formed from the molecular rather than the atomic weight, for Quincke has already found that the weights of drops of similar salts give a constant when multiplied by the molecular weight. This may explain the discrepancy in the case of antimony. The volumes of the drops of lead and bismuth on the one hand and of tin and cadmium on the other are found to be the same.

H. C.

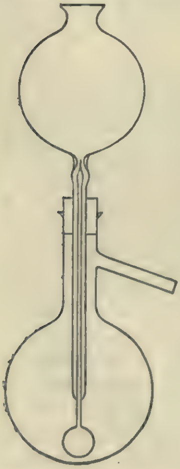
Lamp for the Production of Formaldehyde. By Bernhard Tollens (*Ber.*, 1895, **28**, 261—263).—The production of formaldehyde by the incomplete combustion of methylic alcohol can readily be shown as a lecture experiment if an ordinary spirit lamp be used, and the wick, which should only project very slightly, be surrounded by a cage of fine platinum wire, which should be cylindrical in shape, with a rounded top, and about 2 cm. high by 1 cm. in diameter. A light is first applied, the flame then extinguished for a moment by putting on the glass extinguisher of the lamp, and then the extinguisher removed. The platinum cage remains red hot, and if it be protected from draughts by the tin chimney of an ordinary Bunsen burner, it will continue to glow for hours, large quantities of formaldehyde vapour being produced. The presence of the aldehyde may be recognised by the characteristic odour, or by collecting a little of the vapour in a moistened inverted beaker and adding ammoniacal silver oxide or magenta decolorised by sulphurous acid. Another method of exhibiting the presence of the aldehyde is to collect the vapour in an inverted beaker moistened with ammonia solution, and then add a little water and bromine water. A thick precipitate of hexamethyleneamine tetrabromide is at once produced.

The author suggests that the lamp may be of use for the production of a disinfecting atmosphere, since formaldehyde is preferable to chlorine or sulphurous anhydride in many cases. A. H.

A New Laboratory Barometer. By LÉON MAQUENNE (*Bull. Soc. Chim.*, 1894, [3], **11**, 447—448).—A portable syphon barometer, arranged to give corrected values of pressure with two readings and one addition or subtraction. The diameter of the reservoir is considerably greater than that of the tube; the latter alone is graduated, and the graduations are arranged to allow for the change of level in the reservoir, so that the corrected height is given by a single reading. The temperature correction is given by an attached thermometer, graduated to show the various values of $750(\alpha - K)t$, where 750 = mean barometer height in mm., K and α = coefficient of expansion of glass and mercury, t = temperature. The neglect of the variation of this temperature correction with the height of the barometer involves a maximum error of only 0·1 mm. The instrument is therefore available for all ordinary purposes. JN. W.

Substitute for a Funnel in Filtering. By ARTHUR M. EDWARDS (*Chem. News*, 1895, **71**, 40).—A perforated piece of celluloid, bent to the shape of a funnel, is used by the author for supporting the filter-paper. D. A. L.

Simple Substitute for a Separator Funnel. By D. HOLDE (*Zeit. anal. Chem.*, 1895, **34**, 54).—An ordinary bottle or flask is fitted with a cork, through which pass two tubes. One of these, terminating inside level with the cork, is furnished with a stop-cock or pinch-clamp. The other, reaching to the bottom of the vessel, is there narrowed to a point, and serves to admit air. After shaking, the vessel is inverted for drawing off the two layers separately. M. J. S.



Constant-level Apparatus. By JOHN C. CHORLEY (*Analyst*, 1895, **20**, 16).—The small bulb at the end of the long, thin tube (see illustration) floats on the surface of the liquid. Its ground upper end fits into the thickened part of the larger tube, and prevents the liquid contained in the large bulb from flowing into the flask. When, however, the level of the liquid falls, the upper end of the long tube drops away and releases a small quantity of the liquid, so that the level is automatically maintained during the distillation. L. DE K.

Sodium Press as Modified by E. Beckmann. By REINIGER, GEBBERT, and SCHALL (*Ber.*, 1895, **28**, 322—324).—The principal improvements are two. The screw and plunger are made of separate pieces of metal, and joined in such a manner that when the former is rotated the latter moves vertically. The lower part of the cylinder is removable without interference with the rest of the press, so that various shaped nozzles may be used to give wire or ribbon, as desired. J. B. T.

Two New Laboratory Apparatus. By HANS LOESNER (*J. pr. Chem.*, 1894, [2], **50**, 561—562).—A stirring apparatus and a water bath are figured. The former consists of a perforated porcelain or metal cylindrical shell, vertically disposed, and having for its axis a rod which is capable of rapid rotation by a small water turbine attached to the same retort stand. The water bath is of a common pattern, but is fitted with an iris diaphragm in place of the usual rings. A. G. B.

Inorganic Chemistry.

Combination of Sulphur with Iodine. By C. E. LINEBARGER (*Amer. Chem. J.*, 1895, **17**, 33—59).—By mixing solutions of iodine and of sulphur in carbon bisulphide, and allowing the mixtures to evaporate, the only compound of sulphur and iodine obtained had the formula S_nI_n; it crystallised in black, rhombic tablets, melting at 66·1—66·2°. The same compound was obtained by the action of sulphur chloride (S_2Cl_2) on ethylic iodide, on propylic iodide, and on amylic iodide. Determinations of the variation of melting point of different mixtures of sulphur and iodine gave a curve indicating the formation of only one compound, of the formula S_nI_n. From analogy with the chloride and bromide, it is probable that the formula is S_2I_2, and this is confirmed by the influence exerted by the compound (and also by varying mixtures of sulphur and iodine) on the boiling point of carbon bisulphide. Whilst these results do not exclude the possibility of the existence of other compounds of sulphur and iodine, no indication of their formation could be obtained. The compound S_2I_2 itself is in a very feeble state of combination, and sulphur and iodine atoms seem to have more tendency to form molecular aggregations than to combine with each other.

Full details and curves of results are given, and also a historical survey of previous work on the subject. L. T. T.

Preparation of Nitric Oxide. By MASUMI CHIKASHIGÉ (*Chem. News*, 1895, **71**, 16—17).—Contrary to the experience of Johnstone (Abstr., 1882, 692), the author finds that when potassium thiocyanate and cobalt nitrate are heated together, whether dissolved or not, no evolution of nitric oxide takes place; but in the latter case, by continuing the heating after evaporating to dryness, a violent action soon sets in, with copious disengagement of gas, consisting (to the extent of about two-thirds) of nitric oxide, mixed chiefly with nitrogen; carbonic anhydride and ammonia are likewise produced. The residue is then ammoniacal and black, owing to the presence of cobalt sulphide, but, unlike Johnstone's residue, it does not contain free sulphur or carbon. The action of dilute nitric acid on potassium thiocyanate is, however, not affected by the presence of cobalt nitrate. Possibly Johnstone's cobalt nitrate solution contained free nitric acid.

D. A. L.

Action of Metals on Nitric acid. By GEORGE O. HIGLEY (*Amer. Chem. J.*, 1895, **17**, 18—27).—This is a continuation of the work of Freer and Higley (Abstr., 1893, ii, 273). Acids of different strengths were employed, the acid being always in large excess. The metals experimented with were copper and lead. No successful results could be obtained with lead on using acid of sp. gr. above 1·35, as the insolubility of lead nitrate in strong nitric acid caused the formation of a protective coating of salt over the metal. The author draws the following conclusions. 1. Nitric acid of sp. gr. 1·30, or more, when reduced by copper, yields only nitrous anhydride and nitric peroxide, the former increasing and the latter diminishing rapidly with increasing dilution of the acid. 2. Nitric oxide is a product of decomposition of nitrous anhydride and nitric peroxide, when the sp. gr. of the acid is 1·25 or more; and of nitrous anhydride alone when the gravity of the acid is below 1·25. 3. Lead reacts much more readily than copper, producing with equal concentration of acid relatively much more nitrous oxide, and less of the higher oxides of nitrogen. 4. The remarkable difference in the composition of the products of reduction favours the theory of direct deoxidation rather than that it is due to nascent hydrogen. L. T. T.

Volatilisation of Carbon. By HENRI MOISSAN (*Compt. rend.*, 1894, **119**, 776—781).—When a carbon tube of about 1 cm. diameter is heated in an electric furnace with an arc produced by a current of 2,000 ampères and 80 volts, a light black cloud forms in the interior, in consequence of the condensation of carbon vapour. If a dish containing crystallised silicon is placed in the tube, the silicon melts and then boils, and its vapour, coming into contact with the vapour of the carbon, forms slender needles of carbon silicide. No evidence of the fusion of carbon can be obtained, even with a current of 2,200 ampères and 70 to 80 volts, although the temperature is sufficiently high to rapidly volatilise calcium and magnesium oxides. With powerful currents like these, it would seem that with a small furnace the temperature increases with the intensity of the current, although probably with weaker currents the temperature is to some extent limited by the volatilisation of the carbon.

In all cases, the carbon subjected to these high temperatures is converted into graphite. The black deposit formed on the internal surface of incandescent lamps consists of amorphous graphite mixed with crystals of carbon silicide and some other crystals that seem to be silica.

The carbon vapour, whether condensed in a carbon tube, or on the exterior of a copper tube kept cool by internal circulation of water, or on the electrodes themselves, condenses always in the form of graphite, and the deposits show no traces of fusion.

When the filament of an incandescent lamp breaks, the fractured ends show no traces of fusion, but are covered with small crystals of graphite.

It follows that carbon, like arsenic, volatilises under ordinary pressure without previously fusing. It is probable, however, that under a sufficiently high pressure fusion would take place. The diamonds obtained by the author in ingots of iron cooled in lead have the appearance of elongated drops, and Brazilian and Cape diamonds are found without any apparent crystalline form, but with the rounded forms assumed by a liquid kept in fusion in the interior of a pasty mass. C. H. B.

Double Chlorides and Bromides of Cæsium, Rubidium, Potassium, and Ammonium with Ferric Iron. Two Ferroso-ferric Double Bromides. By P. T. WALDEN (*Amer. J. Sci.*, 1894, [3], **48**, 283—290).—The following ferric salts were obtained.

3 : 1 Type.	2 : 1 Type.	1 : 1 Type.
Cs_3FeCl_6,H_2O	Cs_2FeCl_5,H_2O	$CsFeCl_4,\frac{1}{2}H_2O$
—	Cs_2FeBr_5,H_2O	$CsFeBr_4$
—	Rb_2FeCl_5,H_2O	—
—	Rb_2FeBr_5,H_2O	—
—	K_2FeCl_5,H_2O	—
—	$(NH_4)_2FeCl_5,H_2O$	—
—	—	$NH_4FeBr_4,2H_2O$.

The compounds K_2FeCl_5,H_2O and $(NH_4)_2FeCl_5,H_2O$, have been previously made by Fritzsche (*J. pr. Chem.*, **18**, 483). The salt, Rb_2FeCl_5,H_2O, is probably Godeffroy's salt, Rb_3FeCl_6, as the author was unable to obtain any rubidium salt of this formula. The salt $CsFeCl_4$ is so very hygroscopic that it is very difficult to analyse, and it is possible that it is really an anhydrous salt, and that the $\frac{1}{2}H_2O$ found was hygroscopic moisture.

Two unstable, dark green compounds, $RbBr,FeBr_2,2FeBr_3,3H_2O$ and $KBr,FeBr_2,2FeBr_3,3H_2O$, were also prepared, but no similar compounds could be obtained with the other alkali or ammonium haloids. The crystals of the rubidium salt are rhombohedral, those of the potassium salt cubical. L. T. T.

Cæsium-Cobalt and Cæsium-Nickel Double Haloids. By G. F. CAMPBELL (*Amer. J. Sci.*, 1894, [3], **48**, 418—420, and *Zeit. anorg. Chem.*, **8**, 126).—The following salts were obtained.

3 : 1 Type.	2 : 1 Type.	1 : 1 Type.
Cs_3CoCl_5	Cs_2CoCl_4	$CsCoCl_3,2H_2O$.
Cs_3CoBr_5	Cs_2CoBr_4	—
—	Cs_2CoI_4	—
—	—	$CsNiCl_3$
—	—	$CsNiBr_3$.

These results show that cobalt forms double salts more readily than does nickel, and also confirms the previously observed increase in ease of formation of double salts from the iodides to the chlorides.

The colour of the chlorides containing cobalt is a magnificent blue, the bromides and iodides containing the same metal are green, and the two nickel salts yellow. All the salts are crystalline, and whiten, from decomposition, when brought in contact with water or alcohol.

L. T. T.

Solutions of Metallic Silver. By M. CAREY LEA (*Amer. J. Sci.*, 1894, [3], **48**, 343).—The solutions of metallic silver previously described by the author (Abstr., 1892, 15, and 116) are colloidal, and will not pass through membranes. They are perfect solutions showing no turbidity, even when viewed under a top light so that the incident ray makes a right angle with the line of view. This disproves the contention of Barus and Schneider that in them the silver is not allotropic, but is ordinary silver in a very fine state of division. When carefully made, they are very permanent; one, kept exposed to daylight for three years, still contained much dissolved silver, although part of the silver was deposited in a white metallic form where the light was strongest.

L. T. T.

Action of Dry Hydrogen Chloride on Serpentine. By EDWARD A. SCHNEIDER (*Zeit. anorg. Chem.*, 1894, **8**, 98—102). An answer to R. Brauns (Abstr., 1894, ii, 284).—From the analytical data given in the original paper, the author concludes that (1) water is formed by the action of dry hydrogen chloride on serpentine; (2) a portion of this water is carried away by the hydrogen chloride, the remainder being retained by the silicate residue; (3) the silicate residue, when treated with dry hydrogen chloride, behaves in the same manner as the original serpentine, and water and magnesium chloride are formed; part of the water is retained by the silicate residue.

E. C. R.

Atomic Weight of Thallium. By CHARLES LEPIERRE (*Bull. Soc. Chim.*, 1894, [3], **11**, 423—424).—The mean of the author's results calculated by Clarke (*J. Amer. Chem. Soc.*, **16**, No. 3), namely, 203·57, is too low, owing to the inclusion of a number misprinted in the original paper. The true mean is 203·62. The author raises the question: to what point is it justifiable to maintain the immutability of the atomic weights?

JN. W.

The Molecular State of Mercurous Chloride Vapour. By VICTOR MEYER (*Ber.*, 1895, **28**, 364—366; compare this vol., ii, 46).—

In reply to the renewed criticism of Fileti (*J. pr. Chem.*, [2], **51**, 197), the author again points out that his experiments show that Fileti's gold amalgamation test does not succeed even with a mixture known to contain the vapours of mercury and mercuric chloride. The extent of dissociation of the mercurous chloride vapour would only be diminished by the introduction of an excess of mercuric chloride vapour if the dissociation were incomplete, not when, as is really the case, it is complete (compare Horstmann, *Annalen*, Suppl. **6**, 74). The author's experiments throw no light on the molecular formula of mercurous chloride. A. H.

Action of Aluminium on Carbon and its Compounds. By LÉON FRANCK (*Bull. Soc. Chim.*, 1894, [3], **11**, 439—446).—Mallet has shown (Trans., 1876, 349) that carbonic oxide is reduced to carbon by aluminium. The action on carbonic anhydride is similar, as, when aluminium powder is heated to redness in a stream of that gas, the latter is reduced to carbon.

The alkali carbonates are reduced to metal when heated with aluminium in the proportion $M_2CO_3 : 2Al$. The yield of lithium and potassium is good, and, as the carbonic oxide compound is not formed in the latter case, the process promises to become of commercial importance. The reaction with sodium carbonate proceeds best in an atmosphere of hydrogen.

Aluminium carbide is formed by heating aluminium powder with lamp-black; it yields acetylene in abundance when treated with dilute hydrochloric acid. The author has not yet succeeded in separating it from unchanged lamp-black. JN. W.

Atomic Weight of Nickel and Cobalt. By CLEMENS WINKLER (*Zeit. anorg. Chem.*, 1894, **8**, 1—11).—The method of determining the atomic weights of nickel and cobalt by treating the pure metal with an excess of sodium aurochloride, or potassium aurochloride is not accurate, because the precipitated gold always contains small quantities of nickel or cobalt. The results obtained by warming the metal with hydrochloric acid containing platinic chloride, passing the hydrogen evolved over glowing copper oxide, and weighing the water formed, are not satisfactory. The numbers obtained varied, in the case of nickel, from 58·9494 to 59·2241, and in the case of cobalt from 59·0161 to 59·3487.

The method which the author finds most satisfactory, is to deposit the metal by the electric current on a platinum electrode, dissolve it in an excess of iodine in potassium iodide, and then estimate the excess of iodine by sodium thiosulphate.

The iodine employed was purified by mixing it with 10 per cent. of its weight of freshly-heated potassium iodide, allowing the mixture to remain for some weeks in thin layers over sulphuric acid, and then subliming the iodine into a perfectly dry, stoppered bottle. One part by weight of the metal is treated with 5 parts of the pure iodine, and with the same quantity of potassium iodide in the form of a 40 per cent. solution, and the mixture is allowed to remain one day in a tightly stoppered vessel. The excess of iodine is estimated by means of a solution of sodium thiosulphate, of which 1 c.c. = 0·012645 gram of iodine.

The pure nickel is prepared as follows. 32·84 grams of the purest nickel sulphate is dissolved in 1 litre of water. 200 c.c. of this solution is mixed with 30 grams of ammonium sulphate, 50 grams of ammonia (sp. gr. = 0·905), and 250 c.c. of water, and the nickel deposited on a highly polished nickel cathode, the anode being of platinum. A current of 2·8 volts and 0·8 ampère is employed, the current density being 0·5 ampère per 100 sq. cm. The current is continued until the deposited nickel separates from the cathode in thin plates. The metal is then heated in a current of dry hydrogen. No alteration in weight was observed after heating in hydrogen, showing that the metal was quite free from oxides.

The pure cobalt is prepared in a similar way. The electrolyte consists of 100 c.c. of a solution of cobalt sulphate containing 11·64 grams of cobalt per litre, 30 grams of ammonium sulphate, 30 grams of ammonia, and 500 c.c. of water. A platinum cathode and anode were employed. A current of 3·0 volts and 0·7 ampère is employed, the current density being 0·6 ampère per 100 sq. cm. The metal thus obtained is contaminated with a small quantity of oxide, which is reduced by heating it in a current of hydrogen. Two preparations contained 0·32 and 0·21 per cent. of the cobalt as oxide respectively.

The mean results obtained from the first series of five experiments were (1) Ni = 58·6878, Co = 59·3849; from the second series of three experiments, (2) Ni = 58·7433, Co = 59·3507. This gives, as the mean of all the observations, Ni = 58·7155, Co = 59·3678, taking H = 1 and I = 126·53. E. C. R.

Action of Reducing Agents on Potassium Nickelocyanide and Magnetic Oxide of Nickel. By Thomas Moore (*Chem. News*, 1895, **71**, 81—82).—Continuing his experiments, the author finds that the red compound (Abstr., 1894, i, 102) may also be obtained from potassium nickelocyanide by the action of zinc coated with silver or copper, or by the electrolysis of the solution in the presence of excess of alkali with a mercury cathode; potassium cyanide is set free. By adding nickel sulphate to convert this into the double cyanide, and by continuing the electrolysis, a more concentrated red solution may be obtained, but ultimately the mercury commences to swell up, in a manner similar to ammonium amalgam, and minute mercury globules float in the solution; the precipitate which the red solution gives with hydrochloric acid is decomposed on drying, and the isolation of the cyanide has not been accomplished. The oxide, however, has been obtained by boiling the solution with ammonium chloride in a non-oxidising atmosphere, washing the precipitate free from cyanide, &c., by decantation, first with hot water, then with boiling dilute ammonia containing a little ammonium chloride, and finally with distilled water. When dried at 100°, it is a heavy, black mass, strongly magnetic, not attacked by carbonic oxide, and apparently not altered by exposure to the air at the ordinary temperature; it is soluble in sulphuric acid with evolution of hydrogen, and in nitric acid with evolution of red fumes, green nickel salts being formed in both cases. Potassium cyanide dissolves it with evolution of hydrogen, and, if in a non-oxidising atmosphere, with partial reproduction of the red cyanide. It is decomposed by silver nitrate with the separation of metallic silver. Although it has not been obtained in a state of purity, numerous analyses point to a hydrated nickel suboxide, Ni_3O_2,H_2O, a composition foreshadowed by the results of previous experiments (*loc. cit.*). D. A. L.

Titanium. By EDWARD A. SCHNEIDER (*Zeit. anorg. Chem.*, 1894, **8**, 81—97).—The product obtained by reducing potassium titanofluoride with sodium in an atmosphere of pure hydrogen is not pure titanium. It gave, on analysis, insoluble residue (TiCu and TiO_2) = 4·53 per cent., H_2O = 0·74, Ti = 84·88, Cu = 2·52, Fe = 0·18, O = 6·36, KF,NaF and H by difference = 0·79 per cent. Disregarding the other impurities, these numbers give Ti = 75·34 per cent., TiO_2 = 15·90 per cent. This impure amorphous titanium absorbs hydrogen with avidity, and takes fire on exposure to air, with the formation of water and titanic acid. Titanium which has been in contact with water for some time does not take fire spontaneously on exposure to air, but, on heating, it burns, with the production of the hydrogen flame. The author was unable to determine whether a titanium hydroxide or hydride is formed. 0·0986 gram of titanium when treated with hydrochloric acid, gave 65·37 c.c. of hydrogen, whereas, according to the equation $Ti + 3HCl = TiCl_3 + 3H$, only 60·52 c.c. hydrogen should have been produced. The impure amorphous titanium, when thoroughly washed with water, does not decompose water at 100°. When heated in the air at 100—120° for 15 hours, it took up oxygen only to the extent of 0·06 per cent., and, after heating for 17 hours at 150—160°, the oxygen absorbed only amounted to 0·48 per cent. It is scarcely attacked by dilute hydrochloric acid at the ordinary temperature, and the fuming acid acts only slowly at 15°. At temperatures up to the melting point of combustion tubing, titanium does not reduce either silica or alumina.

An alloy of titanium and copper is obtained by reducing potassium titanofluoride with sodium in the presence of copper at a bright red heat. It is hard and brittle, and contains 11·85 per cent. of titanium. If the reduction is conducted in a copper vessel, the latter becomes covered with a silver-white coating of the alloy, and is hard enough to withstand scratching with steel. If aluminium is melted with titanic oxide and copper under a protecting layer of sodium and potassium chlorides, an aluminium bronze is obtained, containing small quantities of titanium.

Titanium nitride.—The product obtained by heating titanium ammonio-chloride in a current of ammonia, according to the author's analysis, contains 5·4 per cent. of oxygen. When heated for half an hour at a red heat in a current of steam, 41·83 per cent. remains unchanged, and, when heated for an hour in dry hydrogen chloride, 67 per cent. remains unchanged. When heated at a white heat in a current of nitrogen, the indigo-blue nitride is converted into a brownish-yellow product and loses about 3·9 per cent. in weight. When titanium, prepared in the above manner, is heated at a red heat in a stream of ammonia, the indigo-blue nitride is also obtained. In the hope of determining the relative affinity of nitrogen to titanium, boron and magnesium, the author heated titanium nitride with magnesium and boron, boron nitride with magnesium and titanium, and magnesium nitride with boron and titanium, but in neither case was any action observed.

A crystalline, greyish-black sulphide, probably titanium sesquisulphide, is obtained by heating the above blue nitride to redness and passing over it sulphur vapour by the aid of a current of hydrogen.

Titanium tetrachloride cyanobromide, $TiCl_3 \cdot N \vdots CClBr$, is obtained by gently heating a mixture of cyanogen bromide and titanium tetrachloride. It crystallises in beautiful crystals, resembling in colour potassium aurochloride, and forms a cherry-red additive product with dry ammonia. When heated in ammonia, it yields the nitride and some cyanamide. When a mixture of cyanogen and nitrogen is led over titanium at a red heat, an amorphous, black compound is obtained, which, when heated in a current of dry chlorine, yields titanium tetrachloride cyanochloride, and titanium tetrachloride.

The author was unable to prepare titanochloroform. Dry hydrogen chloride forms with titanium at 300° a non-volatile compound containing chlorine. Probably titanochloroform is formed, together with titanium tetrachloride, at higher temperatures.

When a solution of titanic acid in sulphuric acid is mixed with an insufficient quantity of tartaric acid, and is then incompletely neutralised with ammonia, the titanic acid is precipitated quite free from admixture with iron. The titanic acid thus obtained becomes gelatinous by repeated treatment with water, then dissolves in a large quantity of water, and may be further purified by dialysis. E. C. R.

New Methods of obtaining Platinosochlorides, and Probable Existence of a Platinum Subchloride. By M. Carey Lea (*Amer. J. Sci.*, 1894, [3], **48**, 397—401).—When potassium platinochloride (12 grams) is heated in a covered vessel, on a water bath, with hydrogen potassium sulphite (9 grams) and water (160 c.c.) for 10—12 hours, the reduction is complete, and the red salt crystallises out on evaporation. Similar results are obtained by heating the platinochloride (9 grams) with potassium hypophosphite (1 gram) and water (300 c.c.), at 80—90°, for 18—20 hours. The completion of the action is shown by the pure ruby colour of the solution, the least shade of orange indicating the presence of platinochloride. The first method is the safest, as the reduction cannot go beyond the platinosochloride, but in the second method, the red salt separates more easily and completely, and, with care, very good results are obtained.

If, when reducing with potassium hypophosphite, the action is continued after complete conversion into the red salt, the solution rapidly changes to dark brown. Hydrochloric acid has no effect on this solution, nitric acid decolorises it, potash causes a brown precipitate soluble in excess of the precipitant, and ammonia a brown precipitate insoluble in excess. This compound could not be isolated, but is probably a subchloride. L. T. T.

Mineralogical Chemistry.

Dufrenoysite from the Binnenthal. By HEINRICH BAUMHAUER (*Zeit. Kryst. Min.*, 1895, **24**, 85—87).—The author gives a crystallographical description of some specimens of dufrenoysite from the Binnenthal. The crystals, which were about 2 cm. long and 8 mm. broad, formed rounded prisms, and yielded, on analysis,

Pb.	As.	S.	Sp. gr.
57·42	20·89	22·55	5·52

B. H. B.

Zinckenite from Oruro, in Bolivia. By A. W. STELZNER (*Zeit. Kryst. Min.*, 1895, **24**, 125—127).—A description having been published of sundtite from Oruro (*Zeit. Kryst. Min.*, **24**, 124), the author gives an account of a specimen from the same locality in the museum of the Freiberg School of Mines. This, however, although very similar in appearance, is not sundtite, but an argentiferous zinckenite of the following formula, $2\frac{1}{2}(PbS,Sb_2S_3) + (Ag_2S,Sb_2S_3)$. B. H. B.

Iron Nickel Pyrites from Norway. By J. H. L. VOGT (*Zeit. Kryst. Min.*, 1895, **24**, 139).—This mineral, first described by Scheerer in 1845, has hitherto been found at but one locality, Espedalen, in Norway. It has, however, now been met with among some nickel ores from Eiterjord, on the southern side of the Beiern river. It is similar in all respects to Scheerer's mineral, except that the proportion of nickel is somewhat less, its analysis having yielded

Fe.	Ni.	Co.	S.	Cu.	Insoluble.	Total.
30·51	32·97	0·45	34·15	0·28	0·29	98·65

B. H. B.

Free Alkaline Earths in Rocks containing Carbonates. By A. LEMOINE (*Bied. Centr.*, 1894, **23**, 726—728; from *Jour. Assoc. anciens élèves Inst. Agric., Gembloux*, 1894, **4**, 275—280).—Raspail has stated that free calcium oxide occurs in some rocks containing carbonates. The lime cannot be detected by means of the usual indicators, since the carbonates dissolve sufficiently in boiling water to give an alkaline reaction. The following results of analyses of two rocks, (A) Russian limestone, (B) Belgian dolomite, point to the presence of free alkaline bases.

	Water.	Organic matter.	Combined water.	SiO_2.	Fe_2O_3.	Al_2O_3.	P_2O_5.
A	0·174	0·295	—	0·813	0·075	0·162	0·052
B	0·244	1·610	2·190	0·656	0·602	0·063	—

	SO_3.	CO_2.	CaO.	MgO.
A......	0·002	43·003	55·098	0·370
B......	—	38·070	33·862	21·812

Supposing the carbonic anhydride to be in combination with lime and what is over with magnesia, A will contain 0·370 per cent. of free lime and 0·370 per cent. of free magnesia, whilst B will contain 11·380 per cent. of free magnesia. The silica in A is present as quartz sand, and is not combined. When the powdered limestone is shaken with water, it at once shows an alkaline reaction.

As regards the presence of the free bases, it is supposed that waters containing the free bases and organic matter became mixed, giving rise to a precipitate consisting of the organic matter and alkaline earths. This decomposed with production of carbonates, any excess of bases over the carbonic anhydride produced remaining free. The density of the layers prevented the subsequent percolation of water containing carbonic anhydride.

If the author's theory is correct, it involves the formation of the strata in question in a shorter time than has hitherto been supposed. N. H. J. M.

Kämmererite from Tampadel, in Silesia. By K. Kosmann (*Zeit. Kryst. Min.*, 1895, **24**, 198).—In the chrome iron ore deposit, near Tampadel, kämmererite, or rhodochrome, occurs with quartz and chlorite, in the form of violet to greenish, transparent, pyramidal crystals 5 to 6 mm. in length.

An analysis of magnochromite, from the same district, gave the following results.

Cr_2O_3.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	SiO_2.
40·25	19·90	1·48	13·46	16·79	7·80

together with traces of vanadium. B. H. B.

A New Arsenate from Laurium. By L. Milch (*Zeit. Kryst. Min.*, 1895, **24**, 100—103).—In a series of minerals from the Laurium mines, in Greece, a new mineral resembling scorodite was found. It occurs in the form of brownish-red, minute crystals, belonging to the rhombic system, and giving, on analysis, the following results.

As_2O_5.	SO_3.	Fe_2O_3.	PbO.	SiO_2.	$CaCO_3$.	H_2O.	Total.
33·44	3·74	34·53	10·63	1·13	1·46	15·55	100·48

The formula is $2PbSO_4,6As_2O_8(FeOH)_3 + 27H_2O$. For this new mineral the author suggests the name of *lossenite*, in memory of C. A. Lossen. B. H. B.

Phenacite from Ober-Neusattel. By Carl Vrba (*Zeit. Kryst. Min.*, 1895, **24**, 119—123).—At Ober-Neusattel, near Pisek, in Bohemia, the author has found in the felspar and quartz several cavities lined with phenacite and albite. Crystallographically, the phenacite resembles that of Reckingen, in Switzerland, and that of Mt. Antero, in Colorado. Analysis yielded the following results.

SiO_2.	BeO.	H_2O.	Total.	Sp. gr.
54·27	45·17	0·53	99·97	2·963

B. H. B.

Beryl from Pisek. By CARL VRBA (*Zeit. Kryst. Min.*, 1895, **24**, 104—112).—After tourmaline, beryl is the most frequent accessory constituent of the pegmatites of the Pisek district. The author gives a full crystallographical description of the two varieties met with, the opaque beryl and the precious beryl. The former, on analysis, gave the following results.

SiO_2.	Al_2O_3.	Fe_2O_3.	BeO.	CaO.	MgO.	Total.
66·95	18·37	1·41	12·29	0·56	1·12	100·70

B. H. B.

Physiological Chemistry.

Effect of Calcium Phosphate and Carbonate on Increase of Live Weight. By J. NEUMANN (*Bied. Centr.*, 1895, **24**, 34—35; from *Jour. f. Landw.*, **42**, 33).—In the author's experiments on the assimilation of lime and phosphoric acid mixed with food (*Bied. Centr.*, 1894, **23**, 588), the effect of the minerals on the live weight was kept in view. In the two experiments now described, the calves were fed with milk alone, and with milk to which calcium phosphate and carbonate, respectively, were added. The effect of minerals was to increase the change of substance, and hence to diminish the increase in live weight.

The urine of the calves was in each case free from sugar, although 11 grams of milk sugar per kilo. of live weight was given. Stohmann found sugar in the urine of bullocks which had had only 4 grams of sugar per kilo. The nitrogen of the urine was mostly in the form of urea. N. H. J. M.

Action of Intravenous Injection of Sodium Chloride on the Composition of Blood and Lymph. By WILHELM COHNSTEIN (*Pflüger's Archiv*, 1895, **59**, 508—524).—In previous communications, the author advanced certain experiments which tell against Heidenhain's theory that lymph formation is due to a process analogous to secretion by the endothelial cells of the walls of the blood-vessels, and Starling (Abstr., 1894, ii, 424) has also made similar observations. The present experiments with injections of sodium chloride support the previous contention that the alterations in blood and lymph are the consequences of physical processes, especially diffusion and filtration. Any theory of secretory activity is regarded as superfluous. W. D. H.

Ferratin and Iron in the Liver. By FRANZ VAY (*Zeit. physiol. Chem.*, 1895, **20**, 377—402).—Iron in the liver, as a result of the destruction of red blood corpuscles, has been the subject of numerous investigations by microchemical and other methods. Full references are given. Zaleski has described a definite compound to which he has given the name hepatin. Bunge, in egg-yolk, has found an iron compound with nucleo-albumin; and Schmiedeberg (this vol., i, 196) gave the name ferrialbuminic acid or ferratin to a compound in the liver which is coloured black by ammonium sulphide. His method did not lead to the isolation of iron compounds of nuclein from the liver. The present research relates chiefly to the estimation of ferratin in the liver in health and disease. The average in the liver of the lower animals gives a percentage of 0·15—0·3 of ferratin (iron 0·01—0·018 per cent), but the human liver contains less. It runs parallel with the condition of nutrition. In siderosis, of which five cases were examined, there was only one in which the amount of ferratin was increased markedly.

W. D. H.

Red Pigment of "Diemyctylus viridescens." By ARTHUR B. GRIFFITHS (*Compt. rend.*, 1894, **119**, 912—913).—The skins of the small lizard, *Diemyctylus viridescens*, were exhausted with boiling alcohol and ether, and, after evaporating the solvents, the residue was treated with sodium hydroxide solution and the pigment extracted with benzene. It has the composition C, 60·27; H, 4·52; N, 7·16, which agrees well with the formula $C_{20}H_{18}N_2O_7$. It shows no characteristic absorption bands. It dissolves in alcohol, ether, benzene, and carbon bisulphide, but is insoluble in water, acids, and alkalis. When boiled for a long time with hydrochloric acid, the pigment, which the author calls *diemyctylin*, is converted into uric acid, hence it would seem that it is an excretory product deposited under the epidermis.

C. H. B.

Action of Dilute Alkalis on Lower Animals and Plants. By THOMAS BOKORNY (*Pflüger's Archiv*, 1895, **59**, 557—562).—Previous work by the author has shown that certain dilute alkaline substances do not kill some of the lower plants, but cause a change in the cytoplasm which is best designated by Darwin's term "aggregation." The present research deals chiefly with some of the low forms of animal life.

Caffeïne (1 per 1000) does not kill amœbæ, but it causes vacuolation, and increase in the refractive index of the protoplasm—a change very similar to that noted in plant cells; in paramœcium, the change is very similar. Ammonia (which is much more fatal), ammonium carbonate, and potassium hydroxide produce analogous results.

W. D. H.

Rotatory Action of Lactates. By FELIX HOPPE-SEYLER and TRASABURO ARAKI (*Zeit. physiol. Chem.*, 1895, **20**, 365—376).—The paralactates of zinc, calcium, and lithium rotate the plane of polarised light differently in solutions of different degrees of concentration; so that the value $[\alpha]_D$ rises with the dilution of the solution. For equal weights of lactic acid, this value is lowest for calcium and highest for lithium lactate. The lithium salts, on account of their ready solubility, the ease in drying them, and their good crystallisation and relatively high specific rotation, serve well for the estimation of lactic acid by circular polarisation.

The solutions of optically active lactates from rabbit's urine, obtained by lessening the oxygen supply, or by poisoning with carbonic oxide, give values corresponding very well with those of paralactates of the same concentration obtained from meat extract.

In the urine of rabbits which have been subjected for some time to carbonic oxide poisoning, there is found, after subcutaneous injection of an aqueous solution of sodium fermentation lactate, a mixture of optically inactive lactic acid and dextrorotatory lactic acid. The optically active acid indicates a change, in the organism, of part of the lactate given into paralactate. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Effect of Chlorides on the Growth of Plants. By WYPFEL (*Bied. Centr.*, 1894, **23**, 853; from *Bot. Centr.*, 1893, **55**, 182).—The chlorides of magnesium, calcium, potassium, and ammonium, in which the bases are of importance to vegetation, act at first favourably, but afterwards unfavourably on plants, as they become too concentrated, and even destroy the plants. Magnesium chloride was generally the least injurious, potassium and ammonium chlorides the most injurious; 0·3 and 1·0 per cent. solutions of ammonium, lithium, and manganese chlorides killed the plants in a few days. Sodium chloride is more injurious than the chlorides of the first group, and less injurious than those of the second. N. H. J. M.

Transpiration and Assimilation. By E. STAHL (*Chem. Centr.*, 1894, ii, 615—616; from *Bot. Zeit.*, 1894, 117).—When filter-paper, which has been soaked in 1 to 5 per cent. aqueous cobalt chloride, is pressed to both sides of a leaf which has stomata only on the under side, the paper in contact with the underside of the leaf becomes red in a few minutes, whilst the other remains blue for hours.

Starch formation ceases when the stomata are closed with wax, but becomes intense when small cuts are made, indicating that in normal assimilation the gas exchange is through the stomata and not through the cuticula. The case is, however, different when much carbonic anhydride is present, and under the influence of bright light; there is then an intense starch formation, even near the closed stomata. This could be checked by covering the upper as well as the under side of the leaf with wax.

The effect of watering the plant with dilute salt water could also be shown with cobalt paper. The result was a closing of the stomata which continued even in damp air and intense sunlight. Under these conditions there was, moreover, no starch production; but there was a slight production of starch in air rich in carbonic anhydride.

N. H. J. M.

Leaf Respiration. By LÉON MAQUENNE (*Ann. Agron.*, 1894, **20**, 528—532).—The author and Dehérain have already drawn attention to the effect of rise of temperature in increasing respiration in leaves (Abstr., 1887, 172). In the experiments now recorded, leaves of different kinds were placed in small tubes which were then exhausted; after some time the carbonic anhydride produced was pumped out, and then pure air was let in at the ordinary pressure. After an hour or two, this was also pumped out and analysed. Leaves were, of course, selected which do not suffer under this treatment. The results, together with those obtained under normal conditions (in which the leaves were in a vacuum only as long as was necessary to collect the gas), are given in a table, showing weight of leaves, length of time in vacuum and in air, carbonic anhydride evolved in a vacuum, the composition of the final air, oxygen absorbed in the relation CO_2/O_2.

In a vacuum, a larger amount of carbonic anhydride was always produced than under normal conditions: in the case of wall-flowers, for instance, it was just double. The same holds good with regard to the absorption of oxygen. But the increased evolution of carbonic anhydride is by no means proportional to the absorption of oxygen, being sometimes higher and sometimes lower; so that the relation CO_2/O_2 varies considerably. The variation is, however, the same for each species. This difference is probably due to the difference in the chemical composition of the juices of the cells. The relations between plant and air are far more complex than was supposed.

It is concluded that, during the night respiration of plants, a slow combustion of a principle takes place, the formation of which is still going on; this, in consequence, accumulates in absence of oxygen.

N. H. J. M.

Respiration of Green and Etiolated Leaves. By Wladimir Palladin (*Ann. Agron.*, 1894, **20**, 557—558; from *Bot. Centr.*, **58**, 375).—Attempts were made to estimate the energy of respiration of green and etiolated leaves by determining the carbonic anhydride and the relation CO_2/O_2, but without definite results. When green and etiolated leaves were floated on a sugar solution, the intensity of respiration was much increased (1 to 1·6 and 1·7), but if floated on distilled water the amount of carbonic anhydride was reduced from 70·2 to 58·1 milligrams per hour.

When the intensity is expressed in milligrams of carbonic anhydride evolved per 10 grams of proteïds in the leaves, the results obtained with etiolated and green leaves were 169·3 and 163·3 milligrams respectively. There is, therefore, practically no difference if carbohydrates are present in sufficient quantity. It is concluded that proteïds formed in the dark are not more energetic than those formed in the light.

The effect of sugar is natural, since carbohydrates furnish the material for respiration, whilst the respiratory energy is derived from the proteïds: an excess of carbohydrates is without effect.

The respiration coefficient, CO_2/O_2, of etiolated leaves of beans (with which the experiments were made) and of lupins varies between 0·72 and 0·76. Sugar solution has no effect on the relation, but distilled water (in the dark) lowered it to 0·63—0·65.

N. H. J. M.

Pentosans in Plants. By Guillaume de Chalmot (*Amer. Chem. J.*, 1894, **16**, 589—611).—The author finds that pentosans are formed in the stems which are developed from barley seeds germinating in darkness, but that there is no reason to assume that other substances which yield furfuraldehyde, or so-called oxycelluloses, are also present. By far the larger part of the furfuraldehyde-yielding compounds in these stems is, moreover, soluble in very dilute acids and alkalis, and therefore does not belong to the true celluloses.

The amount of pentosans increases in maize which is allowed to germinate in darkness, but this increase is not due to the absorption of pentosans from the soil, but to their formation from other substances present in the stems. The further the development of the young maize plants advances, the larger the quantity of pentosans formed, whereas in the case of peas which germinate in darkness the amount of pentosans at first increases but afterwards decreases. It appears, therefore, that pentosans existing in seeds are gradually decomposed and those in the stems and roots are independently formed. The transformation of pentosans, as such, is therefore only of subordinate importance. Seeds which contain much fat are almost entirely without pentosans, but these increase materially during the germination in darkness. The absence of light appears to have very little, if any, influence on the pentosans during the short time that seeds can develop in darkness. If, in addition to other nutritive matters, nitrates are applied to seeds which are germinating in darkness, the pentosans of the seeds are more readily decomposed, and less pentosans are formed in the stems and roots, which, however, contain more albuminous matter.

The author considers that pentose molecules are formed in complex molecules of hexosans (celluloses and hemi-celluloses), in which a part or all of the aldehyde groups have been bound by condensation and are therefore preserved from further oxidation. Pentose molecules are formed from hexoses by the alcoholic group at the end of the hexose molecule being oxidised to carboxyl, carbonic anhydride being simultaneously split off. G. T. M.

Occurrence of Oxalic acid in Beetroot. By J. Weisberg (*Bied. Centr.*, 1894, **23**, 788; from *Oester.-Ungar. Zeits. Zuckerind. u. Landw.*, **22**, 877—878).—The soluble and insoluble oxalic acid was estimated in aqueous and dilute hydrochloric acid extracts of the roots. The following percentage amounts were found.

Wt. of root (approximate).	Oxalic acid.	
	Soluble.	Insoluble.
400 grams	0·0654	0·0620
500 ,,	0·0461	0·0472

The amount of oxalic acid is thus variable, and the soluble oxalate (chiefly potassium salt) is present in about the same quantity as the insoluble salts. N. H. J. M.

Methylic Salicylate in Indigenous Plants. By Emile E. Bourquelot (*Compt. rend.*, 1894, **119**, 802—804).—Methylic salicylate is present in the roots of *Polygala vulgaris*, L., from which it can be extracted by water, and also in the roots of *P. depressa* and *P. calcarea*, F. In the case of *Monotropa hypopitys*, L., which is parasitic on the roots of pines, methylic salicylate is present in the stalks and can be extracted by means of alcohol of 90°.

When the stalks of *Monotropa* are crushed, the odour of the methylic salicylate is only perceptible after the lapse of a short time, hence it would seem that this compound is present in the form of some complex combination which is broken up by a soluble ferment. The author was unable to isolate any such ferment, but fragments of the stalks of *Monotropa* or of the roots of *Polygala* have the power of splitting up amygdalin in aqueous solution. C. H. B.

Occurrence and Rôle of Myrosin in Plants. By W. SPATZIER (*Bied. Centr.*, 1894, **23**, 785; from *Bot. Centr.*, 1893, **55**, 303; and *Inaug. Diss.*, Erlangen, 1893).—The rôle of myrosin is the production of glucosides. It is, however, not known which glucosides are found besides potassium myronate and sinalbin, what products occur, and whether the products have any other object besides that of protection from external attacks. The manner in which myrosin is formed and whether it has any other function is still uncertain.

N. H. J. M.

Richness of Soil in Nitrogen after the Cultivation of Various Plants. By PROVE (*Ann. Agron.*, 1895, **21**, 46—47; from *Zeits. landw. Ver. Bayern*, 1893, **83**, 59 and 101).—Various plants were grown in clayey sand manured with potassium sulphate and superphosphate, and contained in five pots. There were also two cylinders without vegetation; the soil of one of these was covered with dead moss. The total nitrogen was in each case rather over 7 grams. There was a loss of nitrogen in the soil in every case, and also a loss of total nitrogen. The losses of nitrogen were as follows (1) in soil (2) in total nitrogen (grams).

	Maize.	Rye.	Buck-wheat.	Dwarf beans.	Lupins.	Clover.
(1.)	2·313	2·013	2·189	1·887	1·436	1·403
(2.)	2·029	1·815	1·951	0·862	0·161	0·538

	Horse beans and vetches.	Bare soil.	
		With moss.	Exposed.
(1.)	1·489	0·498	0·217
(2.)	0·106	0·498	0·217

Whilst the *Leguminosæ* yielded about four times as much nitrogen as the non-leguminous plants, they withdrew much less from the soil, and if incorporated with the soil there is less loss than when the soil was kept without vegetation. Frank is wrong in attributing to all phanerogans the power of fixing elementary nitrogen.

N. H. J. M.

Analyses of Silesian Soils. By B. SCHULZE (*Bied. Centr.*, 1894, **23**, 728—731; from *Der Landwirt.*, 1894, Nos. 50 and 81).—The author made analyses of 168 normal Silesian arable soils. The sampling and analyses were all made according to one plan, and the results are, therefore, all comparable with one another. Nitrogen, phosphoric acid, potash and lime were estimated, and in many cases magnesia and iron, &c. Taking the minimum amounts of nutritive constituents which a soil should contain as follows: nitrogen and phosphoric acid, 0·1; potash, 0·08; and lime, 0·25 per cent. in dry soil; the soils are divided under each constituent into those which are deficient and those which are not. A considerable number of soils were deficient in nitrogen, and to remedy this green manuring is recommended for the lighter soils. Phosphoric acid is very important to obtain good yields and good quality of grain and roots. Potash was deficient only in 19 per cent. of the soils, lime in 53 per cent. N. H. J. M.

Experiments on Wheat and Barley at Grignon in 1894. By PIERRE P. DEHÉRAIN (*Ann. Agron.*, 1894, **20**, 561—585).—In order to examine the roots of wheat at different periods of growth, wheat was sown on a bank from which the soil was removed from time to time so as to expose the roots. The first examination was on the 15th December, 1893. The character, length, &c., amount of dry substance as compared with the above-ground growth were noted, and also the amounts of nitric acid in tops and roots. The weight of dry root per cent. of above-ground growth diminished from 73 to 27 by the 13th of May. The nitric acid in the roots diminished continuously, but increased in the above-ground growth until the end of April; by the 13th of May it was less, and a month later there was a great decrease both in above-ground growth and in the roots.

In order to determine the respiratory energy of wheat leaves, which, owing to the short time they exist, might be expected to be great, air was passed over leaves contained in a tube, and analysed by Reissert's method. The results of the experiments, which were made on the 6th June, showed an absorption of 0·19 gram of carbonic anhydride in five hours by a leaf weighing (fresh) 0·353 gram. In a subsequent experiment, however, (22nd June) the absorption was only 0·002 gram by a leaf weighing 0·4 gram. The experiments will be repeated. The stems, when still green, give off carbonic anhydride instead of absorbing it; ears of the average weight, 3·74 grams, gave up 0·010 gram of the gas in five hours.

Although from July wheat plants no longer possess organs able to produce vegetable matter, the weight of the crop still increases. The following amounts of dry produce were obtained from 10 sq. metres:—30th June, 875 grams; 6th July, 977·8 grams; 16th July, 1055·7 grams; 26th July, 1312·4 grams; and 6th August, 1107 grams.

The second part of the paper gives the results of experiments on different varieties of wheat and barley under the influence of different manures. N. H. J. M.

Effect of Manure, Season, and Seed on the Composition of Rye Grain. By M. FISCHER (*Chem. Centr.*, 1894, ii, 173—174; from *Ber. a. d. physiol. Lab. landw. Inst. Univ., Halle*, Heft 10, 34).—Nitrogen-free extract and fat are affected more by the season than by manures; moisture and sunshine during the development of the grain giving rise to a high percentage of the former. Richness in fat is accompanied by a low percentage of nitrogen-free extract, and seems to be favoured by dung and by exclusively nitrogenous manure.

The lowest percentage of ash was also obtained under the influence of nitrogenous manure.

An abundant straw production, whether caused by season, by stable manure, or by an exclusively mineral manure, results in low percentage of nitrogen. The highest percentage of proteïds was obtained with dung, high results with nitrogenous manure alone, and moderate proteïd production with artificial nitrogenous and mineral manures together. Unmanured rye is rather rich in nitrogen.

The percentage relation of pure proteïn to total nitrogen varies generally with the amount of ash, so that with exclusively mineral manure the greatest amount of the nitrogen is in the form of proteïn; with exclusively nitrogenous manure, the least. The greatest and smallest absolute amounts of actual proteïn are produced under the influence of dung and of purely mineral manure respectively; the indigestible nitrogenous matter is fairly constant with the same season, seed, and soil. Grain of low sp. gr. has not only a high percentage of indigestible proteïn-nitrogen, but its relation to total nitrogen is also high. Very low total nitrogen and very high percentage of ash do not necessarily indicate an especially high relation of digestible proteïn-nitrogen to total nitrogen. When the total nitrogen is high and the ash percentage low, the nitrogen of the digestible proteïn is usually low. The employment of dung gives the highest amount of digestible proteïn, both absolute and in relation to the indigestible proteïn. Good results are also obtained by means of a suitable mixture of artificial nitrogenous and mineral manures.

N. H. J. M.

Manuring Experiments with various Phosphates and Nitrogenous Substances. By Lars F. Nilson (*Bied. Centr.*, 1894, **23**, 737—746; *Midd. f. k. landtbr.-akad. exper.*, 1894, No. 24).—In 1889—91 large quantities of apatite were found in North Sweden. The phosphates cannot, however, be worked with advantage in the ordinary manner, but may be treated with the iron ores in the Thomas process. A product, obtained in the course of provisional experiments, in which the apatite could not be mechanically separated from the iron ores, was treated with lime in an ordinary furnace. The resulting slag, when compared with basic slag, as manure for barley was found to have very little effect. After being heated at an intense white heat, it proved to be quite equal to basic slag. As compared with superphosphate, 2 parts of the apatite product (and of basic slag) gave about the same results as 1 part of superphosphate; this is in accordance with Wagner's experiments with basic slag. Comparative experiments were next made with various bone meals—Russian and Swedish steamed bone meals, meal from coprolites, burnt and fused coprolites, and fused bone ash. The ordinary bone meals proved to have but little value, the fused bone ash was as effective as basic slag, or more so, whilst the burnt coprolites had least effect of all, owing to the amount of silica (15 per cent.) they contained and the deficiency of calcium carbonate. If the coprolites were heated with sufficient lime, they would probably be as effective as fused bone ash. In the second and third years of the experiments with bone meal, there was a diminution in the yield of barley.

Experiments on the effect of various phosphates on the composition of the barley grain were next made, the manures selected being basic slag (100 to 200 kilos. per hectare), potassium orthophosphate, potassium metaphosphate, and superphosphate (50 to 100 kilos.). The three soluble phosphates gave equal increase of produce. As regards the amount of proteïn in the grain, there was a decrease which was greater the greater the amount of phosphate applied; without manure, the grain contained 21·5 per cent. of proteïn, whilst with soluble phosphates (100 kilos. per hectare) it was only about 9 per cent., and with basic slag (200 kilos.) about 12 per cent. The soil with which the experiments were made was a peaty soil very rich in nitrogen, and it had also an application of nitrate (25 kilos. per hectare).

Similar experiments made with sugar-beet showed that superphosphate and potassium phosphate gave only 0·6 the amount of sugar that was obtained with the corresponding amount of basic slag.

In the next experiments, the effect of herring-guano on oats as compared with sodium nitrate was investigated. A fine, sandy soil, to which potassium sulphate and basic slag were added, was employed. The herring-guano gave about 80 per cent. of the increase produced by Chili saltpetre containing the same amount of nitrogen; but it is possible that its action might extend to subsequent crops. In absence of potash and phosphoric acid, the effect of herring-guano, as compared with Chili saltpetre, is still less.

The results of the last experiments in which barley, oats, and peas were manured with phosphates, potassium sulphate, and sodium nitrate, indicate that it is the phosphates mainly which increased the yields in the soil employed (peaty soil from Gothland); peas seemed benefited by potash also. The pea straw was increased by the application of nitrate, but the amount of grain diminished.

N. H. J. M.

Varying Composition of Malt: Means of Regulating the Degree of Fermentation. By E. Ehrich (*Bied. Centr.*, 1894, **23**, 840—843; from *Bierbrauer*, 1894, **25**, 339, 411, 435).—The composition of malt varies with the season; the malts of 1893, for instance, were poorer in maltose than those of 1892. Barley and malt produced in different districts also vary. As examples, results obtained with Pilsen, Vienna, and Munich malts in 1892 and 1893 are given. The method now described for regulating the degree of fermentability, especially in the thick mash process, depends on the solubility of diastase in water and on the behaviour of diastase at higher temperatures. At 50° there is an energetic action of diastase on the starch; the action is still stronger at 55° to 64°, at which temperatures most sugar (about 75 per cent.) is formed in the shortest time. At higher temperatures, the starch is still more quickly converted, but the amount of sugar diminishes owing to the production of dextrin. Above 75°, the production of sugar diminishes quickly.

N. H. J. M.

Analytical Chemistry.

Difficulty in the Detection of Chlorine in Methylene Blue. By Wilhelm Lenz (*Zeit. anal. Chem.*, 1895, **34**, 39—48).—A solution of methylene blue hydrochloride of the formula $C_6H_{17}N_3S,HCl$ gives no precipitate with silver nitrate. On then adding nitric acid, a small portion of the chlorine is precipitated, and, on boiling with nitric acid, a larger portion, but in no case could the theoretical amount be obtained. The whole amount (11·4 per cent. of HCl) was, however, obtained when the substance was fused with sodium hydroxide and potassium nitrate before treatment with silver nitrate, or was oxidised in the wet way by the following process, which is of general applicability to organic substances. The extremely finely powdered substance is mixed in a porcelain mortar with dilute soda to a thin paste, and finely-powdered potassium permanganate is added in small portions until the colour of the mixture is that of permanganate without a trace of green. The mass, which has become solid, is mixed with more soda, and dissolved in hot water; the excess of permanganate is reduced with alcohol and the filtered liquid, after acidification with nitric acid, is precipitated with silver nitrate. A similar method serves for the estimation of sulphur, but it is necessary to add the permanganate so slowly that rise of temperature is avoided, and finally to add a considerable excess so that a saturated solution is produced. After remaining for about a week, the mixture is heated with excess of strong hydrochloric acid until all chlorine is expelled. The sulphur in many substances may be estimated by this method, but it fails with others, notably with "saccharin." Specimens of methylene blue (exclusive of those containing zinc chloride) formerly found by the author to give the chlorine reaction with silver nitrate, must, he assumes, have contained more hydrochloric acid than corresponds with the above formula.

Methods of distinguishing methylene blue from other coal-tar dyes are given in the paper. M. J. S.

Chlorine in the Gastric Secretion. By Henri Lescœur (*Compt. rend.*, 1894, **119**, 909—912).—The chlorine present in the gastric secretion as (1) hydrochloric acid, (2) inorganic chlorides, and (3) organic chlorine, is determined according to the method of Hayem and Winter, by estimating the chlorine in three separate quantities of the liquid (*a*) after adding sodium carbonate, evaporating and heating strongly, (*b*) after evaporating at 100°, then adding sodium carbonate and heating, and (*c*) after evaporating and strongly heating without addition of sodium carbonate. The author heats the liquid in a glass flask through which passes a current of air, the issuing gas being passed through a wash-bottle. The products volatilised at 100° are first collected, and afterwards the products of carbonisation.

The two methods gave identical results as regards the hydrochloric acid, provided that a temperature of 100° is not exceeded. The results for organic chlorine are lower by the author's method, but the difference tends to disappear if the flask is heated above 200°. It would seem that part of the chlorine is volatilised in the form of ammonium chloride owing to pyrogenic reactions between the proteïds and the sodium chloride.

The author concludes that the chlorine present in the gastric juice in the form of hydrochloric acid is capable of exact estimation, but the same precision does not obtain in the case of the combined chlorine, and especially of the so-called "organic" chlorine.

C. H. B.

New Gasometric Method of Estimating Nitrogen in Nitrates. By Fr. Gantter (*Zeit. anal. Chem.*, 1895, **34**, 25—32).—The measurement of the nitric oxide evolved by the action of copper and sulphuric acid on a nitrate, yields satisfactory results only when the quantity of nitrate is not too small. The reaction $N_2O_5 + P_2O_3 + 2NH_4Cl = 2N_2 + P_2O_5 + 3H_2O + 2HCl$ is, however, applicable to very minute quantities. It is quantitatively complete, and, owing to the evolution of twice as much nitrogen as is contained in the nitrate, it is very sensitive. The author employs the gas volumeter formerly described (Abstr., 1894, ii, 26), but with the introduction, between the tubes *a* and *b* of the reaction flask, of a special absorption vessel, containing soda to arrest hydrogen chloride. To avoid calculation, 289 milligrams of the substance is used: 5 c.c. of water expelled from the apparatus then corresponds with 1 per cent. of nitrogen as nitric acid. This quantity, contained in 3 c.c. of solution, is placed in the reaction flask with 0·5 gram each of crystallised ammonium chloride and crystallised phosphorus acid, and 2 c.c. of sulphuric acid (2 vols. of concentrated acid with 1 vol. of water). In the pipette B (*loc. cit.*) is placed 5 c.c. of the same acid. After equalising the temperature, the reaction flask is very slowly and carefully warmed. Should the mixture become yellow, or red fumes be evolved owing to too rapid heating, the results are inaccurate. When evolution of gas ceases, the additional sulphuric acid is slowly dropped in and the mixture is finally raised to boiling and boiled vigorously for a few minutes, but not so long as to produce a brown colour from the concentration of the sulphuric acid. The method is very suitable for estimating nitrates in natural waters, and the test analyses with pure substances gave very favourable results.

M. J. S.

Estimation of Phosphoric acid by Titrating the Yellow Precipitate. By B. W. Kilgore (*J. Amer. Chem. Soc.*, 1895, **16**, 765—772).—Methods based on the principle of titrating the yellow precipitate have been described by Thilo, Manby, Handy, and others. The process gives good results, but it is often difficult to prevent an admixture of free molybdic acid, which, of course, renders the result untrustworthy. By operating, however, as follows, the author obtained good results.

Two grams of the phosphate is dissolved in 30 c.c. of nitric acid and 5—10 c.c. of hydrochloric acid, and diluted to 200 c.c.; 20 or 40 c.c. is now put into a beaker, mixed with ammonia until a precipitate just begins to form, and diluted to 75 c.c. If much of the nitric acid was lost when making the solution, 10—15 grams of ammonium nitrate had better be added. After heating on the water bath to 60°, excess of ammonium molybdate solution is added, and after standing for five minutes the liquid is filtered and the precipitate washed by decantation until the washings are no longer acid. The filtration is best carried out by using a Hirsch funnel in connection with a filter pump. The precipitate is then dissolved in excess of standard potash and titrated with standard nitric acid.

The molybdate solution is made by dissolving 100 grams of molybdic acid in 417 c.c. of ammonia (sp. gr. 0·96), and pouring this into 1250 c.c. of nitric acid (sp. gr. 1·20). The solution should be filtered before use. L. DE K.

Volumetric Estimation of Phosphoric acid. By R. SEGALLE (*Zeit. anal. Chem.*, 1895, **34**, 33—39).—Direct acidimetric titration of phosphoric acid, with whatever indicator, does not furnish exact results. The following small modification of Glücksmann's method is both rapid, convenient, and accurate. To the solution of the phosphoric acid, a liberal known excess of a standard ammonia solution is added; then sufficient of a perfectly neutral solution of magnesium sulphate. The mixture is made up to a known volume, vigorously shaken, and immediately filtered through a dry filter. The excess of ammonia is titrated, and 1 mol. of phosphoric acid is calculated for 3 mols. of ammonia which have undergone neutralisation.

M. J. S.

Estimation of Soluble Phosphate. By VINCENT EDWARDS (*Chem. News*, 1895, **71**, 69—70).—The author finds that allowing the precipitate of ammonium magnesium phosphate to settle during either 1½ or 48 hours does not give rise to any variation of importance in the numbers obtained for soluble phosphate in superphosphate; he regards 2½ hours as sufficient to allow for the settlement.

D. A. L.

Estimation of Arsenic and Sulphur. By LEONARD DE KONINGH (*Ned. Tydschr. v. Pharmacie*, &c., 1894, 365—367; 1895, 18—20).—Sulphur may be conveniently oxidised to sulphuric acid by the use of alkaline potassium permanganate. About 0·5 gram of the sample is dissolved in a few c.c. of saturated hot aqueous potash, which is generally completely free from sulphate, the solution is diluted with about 100 c.c. of boiling water, and powdered potassium permanganate is stirred in until the liquid acquires a greenish-red colour. In this way, the sulphur is completely oxidised, and, after heating with excess of hydrochloric acid until a colourless solution is obtained, the sulphate may be precipitated as usual with barium chloride. In arsenic analysis, it is customary to weigh first as sulphide, after removing as far as possible any free sulphur by means of carbon bisulphide, and then to estimate the sulphur in the precipitate. The author advises treating the filter and the precipitate with alkali and permanganate in the way described, the oxidation being instantaneous. The clean part of the filter may be first cut off.

If a mixture of arsenious acid and excess of sulphur is boiled with aqueous potash until everything is dissolved, and then, after cooling, reprecipitated by hydrochloric acid, the precipitate does not contain all the arsenic, as may be proved by passing a current of hydrogen sulphide through the filtrate. If the alkaline solution is boiled with addition of small quantities of basic bismuth nitrate, the bulk of the sulphur is readily removed. This reaction has not been used quantitatively, as the bismuth sulphide is supposed to retain arsenic, but the author states that all the arsenic remains in solution, and may be estimated by acidifying with hydrochloric acid and at once adding excess of bromine. The remaining sulphur is quickly oxidised, and the arsenic passes into the higher state of oxidation, and may then be precipitated by adding ammonia and magnesia mixture. As regards the last reagent, the author states that when stale it is a very treacherous one, often causing a precipitate of magnesium hydroxide, as may be noticed by the occasional bulky appearance of the magnesium ammonium arsenate. The reagent should always be tested to see whether it yields a precipitate on merely adding it to dilute ammonia; should this be the case, it must be mixed with more ammonium chloride. But the safest plan is to filter off the mother liquor, and then redissolve the arsenical precipitate in dilute hydrochloric acid and reprecipitate with ammonia.

The author communicates a test experiment with a mixture of arsenious acid and free sulphur, containing also a small quantity of orpiment. The result of the arsenic estimation was the same whether weighed as arsenic sulphide with subsequent estimation of sulphur, or by the bismuth process. The estimation of the sulphur was controlled by extraction with carbon bisulphide. Allowing for the sulphur existing as orpiment, the result was very satisfactory.

L. DE K.

Estimation of Alkali Hydroxides and Carbonates in the Presence of Alkali Cyanides. By J. E. CLENNELL (*Chem. News*, 1895, **71**, 93—94).—These estimations may be effected by titrating the cyanide directly with silver nitrate; then, in the same solution, with phenolphthalein as indicator, estimating the hydroxide and half the carbonate by titrating with hydrochloric acid. The total alkali is titrated directly with hydrochloric acid, using methyl-orange as indicator. The alkalinity due to the cyanide, hydroxide, and carbonate respectively being calculated from these numbers.

D. A. L.

Decomposition of Sulphates by Ammonium Chloride. By MASUMI CHIKASHIGÉ (*Chem. News*, 1895, **71**, 17).—It is observed that when a mixture of magnesium or sodium chloride with ammonium chloride, ammonia and very little sulphuric acid is evaporated and heated sufficiently strongly to expel the ammonium salts, some sulphuric acid still remains in the residue; this must be taken into consideration in analytical operations involving such treatment.

D. A. L.

Analysis of Sodium Peroxide. By LEONARD ARCHBUTT (*Analyst*, **20**, 1895, 3—5).—After trying the permanganate process with but indifferent success, the author succeeded very well by using cobalt nitrate.

The sample is weighed into a small tube which is placed in a flask attached to a Lunge's nitrometer. In the flask, is put 5 c.c. of water and a drop of cobalt solution; the mercury is then levelled, and on bringing the peroxide into contact with the reagent, the available oxygen is quantitatively liberated and its volume ascertained as usual.

L. DE K.

Estimation of Calcium Oxide in Quicklime. By WINTHROP E. STONE and F. C. SCHEUCH (*J. Amer. Chem. Soc.*, 1894, **16**, 721—723).—One gram of the finely powdered sample is shaken for twenty minutes with 150 c.c. of a 10 per cent. solution of saccharose. Calcium oxide soon dissolves, whilst calcium carbonate, magnesia, ferric oxide and alumina are quite insoluble. The solution is filtered, and the clear filtrate titrated with standardised hydrochloric acid. The test analyses prove the commercial accuracy of the process. L. DE K.

Analysis of Zinc and Copper Alloys. By H. N. WARREN (*Chem. News*, 1895, **71**, 92).—Brass filings are dissolved in strong sulphuric acid, the solution diluted, some magnesium ribbon introduced, and a temperature of 38° maintained, until all the copper is precipitated. This is collected, washed, weighed, and, if other metals of the same group are suspected, further examined. The solution is boiled with strong sodium acetate, the basic ferric acetate filtered off, and the zinc, now present as acetate, precipitated from the filtrate by means of rods of magnesium. D. A. L.

Analysis of American Refined Copper. By HARRY F. KELLER (*J. Amer. Chem. Soc.*, 1894, **16**, 785—789).—The author's method is a slight modification of the thiocyanate process introduced by Hampe; 25 grams of the sample is dissolved in a mixture of 200 c.c. of water, 45 c.c. of nitric acid (sp. gr. 1·21), and 25 c.c., or more, of strong sulphuric acid. When, on heating, no more nitric fumes are given off, the liquid is diluted with 200 c.c. of water, and heated to 40°. A rapid current of sulphurous anhydride is now passed through until all the nitric acid is destroyed, when the liquid becomes turbid owing to the precipitation of silver, selenium and tellurium. After adding a drop of hydrochloric acid to precipitate the last traces of silver, the liquid is allowed to remain for 24 hours in a warm place, and then passed through a small filter. The filtrate may contain bismuth, antimony, iron, nickel, and cobalt.

The sediment is composed of gold, silver, silver chloride, selenium, tellurium, perhaps lead sulphate and traces of bismuth and antimony. To determine the elements in the filtrate, the greater part of the copper must first be removed. For this purpose, a measured amount of standard potassium thiocyanate (1 c.c. = 0·05 cu.) is gradually added, whilst a current of sulphurous anhydride is passed into the liquid. It is preferable to leave a trace of the copper in solution. The mixture is now made up to 2 litres, and after the precipitate has settled, an aliquot part, say 1800 c.c., is filtered. The precipitate may be taken to occupy 16 c.c., so that the total volume of liquid is really 1984 c.c. After expelling the excess of sulphurous anhydride by boiling, the metals are precipitated by hydrogen sulphide and further separated by the usual analytical methods. The insoluble portion is detached as completely as possible from the filter, which is treated with fuming nitric acid in a small porcelain dish; the detached portion is then added and treated with the acid until completely oxidised. After evaporating the excess of acid, the residue is digested with dilute hydrochloric acid to separate the silver. In the filtrate, the tellurium and selenium are precipitated by means of hydroxylamine hydrochloride by aid of a gentle heat. After first weighing the mixed elements on a tared filter, an attempt was made to separate the tellurium by fusing the mixture in a current of hydrogen with potassium cyanide; the aqueous solution was then exposed to the air, causing most of the tellurium to separate.

Gold, lead and the traces of antimony and bismuth are estimated by the ordinary methods. L. DE K.

Examination of Rose Oil for Geranium Oil. By ROBERT JEDERMANN (*Zeit. anal. Chem.*, 1895, **34**, 51—53).—The author controverts the statements of Panajotow (Abstr., 1891, 1855), as to the possibility of detecting geranium oil in oil of roses by either Schiff's reagent or Hager's sulphuric acid test, and states that the oil prepared from white roses yields with the latter a turbidity resembling that produced by geranium oil, whilst with the former he has only known a single case out of hundreds in which a blue colour was not produced after a few hours. The specific gravity test is equally untrustworthy, since the gravity of rhodinol (0·873—0·8735), the elæoptene of rose oil, and its only odoriferous constituent, approaches so closely that of geranium oil (0·882—0·895); the proportion of the valueless stearoptene, which is of lower gravity, varying from 7 to 30 per cent. according to conditions of soil and preparation. The action of rhodinol and geraniol on polarised light is also identical, and he regards them as isomeric substances. At the present time, no trustworthy chemical means exists for detecting this adulteration.

M. J. S.

Procedure in Fehling's Titration. By ARTHUR BORNTRÄGER (*Zeit. anal. Chem.*, 1895, **34**, 19—25).—Of the two methods of procedure studied by Soxhlet, many text-books and official prescriptions adopt that in which undiluted Fehling's solution and a sugar solution of 0·5—1 per cent. are employed. This involves the use of at least 50 c.c. of Fehling's solution for each titration, and the evaporation of weaker sugar solutions. Good results can be obtained by the use of only 10 c.c. of the copper solution diluted with four volumes of water, and, since the water may be derived from the sugar solution itself, this method permits the employment without concentration of sugar solutions of only 0·1 per cent., such as occur in the analysis of fully fermented wines. The mixture should in any case have a total volume of 55—60 c.c. A flask is to be preferred to a basin. In the preliminary titrations, in which the colour of the supernatant liquid is used as a guide, the flask should rest on a white ground, and the sugar solution may be added to the hot copper solution, but the final result should be deduced from the mean of two titrations, differing by only 0·1 c.c., in which the mixtures are made in the cold, and, after boiling for exactly two minutes and filtering, one filtrate gives a brown colour with acetic acid and ferrocyanide, whilst the other does not. A thick paper, or else double or triple filters, should be used to obtain a filtrate perfectly free from cuprous oxide; only a few c.c. of the filtrate should be collected, and the greatest rapidity is essential in order to entirely avoid reoxidation of the precipitate. Sugar solutions of more than 1 per cent. must be diluted to that strength before filling the burette, otherwise errors of reading influence the result too greatly. The copper solution and alkaline tartrate should be preserved separately, and if the tartrate solution is filtered before adding the alkali, it remains unaltered longer. The results should always be expressed in terms of "invert sugar," of which, according to Soxhlet's determination, 10·31 c.c. of a 0·5 per cent. strength reduce exactly 10 c.c. of normal Fehling's solution. Working as above, the use of a sugar solution of only 0·05 per cent. leads to an error not exceeding 4—5 per cent. of the whole amount.

M. J. S.

Ratio of d-Glucose to Levulose in Sweet Wines and Honey, and the Use of this Ratio for Detecting Adulteration. By J. König and W. Karsch (*Zeit. anal. Chem.*, 1895, **34**, 1—18).—The proportions of the two sugars were estimated both by the method of Soxhlet (Abstr., 1880, 758) and that of Neubauer (Abstr., 1877, 641), the results of which agree closely in the case of wine and must. In unfermented must, the *d*-glucose was found to exceed the levulose in the ratio of 100 : 77—84. Fermentation, whether natural or induced by the addition of yeast, removed the *d*-glucose more rapidly than the levulose, so that the proportions speedily became inverted. Cane sugar added to wine is inverted by the acids present, and the fermentation of the two glucoses produced follows the same course as in natural wine. The only conclusion derived from the research is that if a sweet wine contains considerably more levulose than *d*-glucose, it is probably a fermented wine; if, on the other hand, the *d*-glucose preponderates largely, it is likely that no fermentation has taken place.

For the examination of honey, it is necessary to remove the dextrinoïd substances. For this purpose 40 grams of honey is diluted with water to 40 c.c., and 20 c.c. of this mixture is slowly made up to 250 c.c. with absolute alcohol. After 2—3 days, the solution is filtered from the precipitate, and portions of it are used (after expulsion of the alcohol) for the titrations and polarisation. In the case of honey, Neubauer's method gave results differing widely from those of the Soxhlet-Sachsse titrations, the divergence being greatest in those samples (of honey from flowers) which gave the largest amount of precipitate with alcohol. It must therefore be assumed that honey contains constituents possessing reducing powers and optical properties which differ from those of *d*-glucose and levulose, and, in particular, that a strongly dextrorotatory substance is present. The ratio of *d*-glucose to levulose, as estimated by titration, varies largely in different specimens of genuine honey, so that as much as 25 per cent. of starch sugar might be added to certain samples without exceeding the proportion of *d*-glucose found in others. All the natural honeys examined (including that from conifers) show, however, lævorotation after removal of dextrin. Dextrorotation under these circumstances would indicate the addition of starch sugar.

M. J. S.

Comparison of Methods for the Estimation of Starch. By Winthrop E. Stone (*J. Amer. Chem. Soc.*, 1894, **16**, 726—733).—The author has tried, side by side, five different processes for the estimation of starch, including four inversion processes and the baryta process. [The latter method, as described by the author, differs considerably from the original method.—Abstractor.] The results were in every case very satisfactory when dealing with pure starches, but all methods failed when applied to meals and fodders. Hay and cotton-seed meal, for instance, which gave no iodine reaction for starch, still should have been credited with containing large amounts of that substance when tested by the quantitative methods, particularly if analysed by the baryta process.

This leads to the unavoidable conclusion that besides starch, other substances are often present which behave quantitatively like starch; these, no doubt, belong to the pentosans. L. de K.

Estimation of Woody Fibre in Fodders. By A. P. Aitken (*Analyst*, 1895, **20**, 35—37).—The great drawback of the old *acid and alkali* process for the estimation of woody fibre is that it only gives concordant results when the strength of the solutions, and also the time of boiling, is always the same. The strength, however, increases during the boiling, and it is therefore necessary to almost constantly add boiling water to replenish the loss caused by evaporation. Although this may be avoided by using a reflux condenser, the danger of frothing is also to be considered. The author now proposes to put the liquids into beakers covered with watch-glasses, and to immerse them in a steam bath. In this manner the temperature of boiling water is maintained, whilst practically no evaporation takes place. L. de K.

Bell's Analyses of Genuine Milk. By John F. Liverseege (*Analyst*, 1895, **20**, 7—12).—The author states that milk analysed by Bell's process may show from 0·4 per cent. less to 0·26 per cent. more fat than when analysed by the specific gravity and total solids method.

The great bulk of Bell's analyses are, however, quite in accordance with the generally accepted ideas about the composition of average natural milk. L. le K.

The Keeping of Milk for Analysis. By M. Kühn (*Bied. Centr.*, 1895, **24**, 68; *Der Landwirt.*, 1894, Nos. 40—43).—For keeping milk only a few days, 0·2 to 0·3 gram of potassium dichromate is added per litre; otherwise about 1 gram is employed (Alén, *Bied. Centr.*, **23**, 121). Milk so treated gives turbid solutions when examined by Soxhlet's areometric method, and the separation of the ethereal solution is sometimes difficult. To avoid this it is proposed to put a cotton-wool plug (10—20 mm. long) in the tube which dips into the ethereal fat solution, and to force the fat solution into the apparatus by pouring water in, instead of by means of bellows (compare Milchzeit, 1891, No. 40).

The sp. gr. of the milk can be determined if the amount of potassium dichromate added is known. The addition of 1 gram of the salt to 1 litre of milk raises the sp. gr. "one degree" (*sic*).

N. H. J. M.

The Twitchell Method for Estimating Rosin in Soap. By THOMAS EVANS and I. E. BEACH (*Amer. Chem. Journ.*, 1895, **17**, 59—67).—The authors have noticed that rosin generally contains from 6—9 per cent. of unsaponifiable matter which, no doubt, accounts for the indifferent results obtained by some investigators when using Twitchell's process (Abstr., 1892, ii, 389; 1893, ii, 609) for the estimation of rosin in a mixture of the same with fatty acids. To render the process a really good one, from a soap manufacturer's point of view, a good method for the estimation of this unsaponifiable matter will have to be discovered. L. DE K.

Gladding's Process for Estimating Rosin in Soap. By LEONARD ARCHBUTT (*Analyst*, 1895, **20**, 6—7).—This process is seriously interfered with by the presence of unsaponified fat. Gladding's directions as regards this matter are not stringent enough, and the author therefore advises either to boil the sample with excess of alkali, or to remove the fat from its aqueous solution by shaking with ether. The soap thus purified is then decomposed with acid and the liberated fatty acids treated according to Gladding's directions. L. DE K.

Estimation of Glycocine. By MAX GONNERMANN (*Pflüger's Archiv*, 1894, **59**, 42—46).—Fischer (Abstr., 1894, ii, 336) has introduced a method of estimating glycocine by converting it into hippuric acid; he, moreover, finds that 100 grams of gelatin yields 9 grams of hippuric acid or 3·78 of glycocine. The present research confirms the value of this method so far as glycocine is concerned, but with gelatin the result was different, being much higher; the number given is from 7·73 to 8·44 instead of 3·78. W. D. H.

Table for the Estimation of Urea by Riegler's Method. By LUDWIG VANINO (*Zeit: anal. Chem.*, **34**, 55—57).—This is a table for the reduction to milligrams of urea of the volume of gas (CO_2 + N) evolved by the action of Millon's reagent (Abstr., 1894, 166).

M. J. S.

Optical Method for Estimating Albumin and Uric acid in Urine. By A. CLARENCY (*J. Pharm.*, 1894, [5], **30**, 484—487).—The methods at present used for the estimation of albumin and of uric acid in urine are difficult and tedious. The author obtains very good results by means of the Aglot apparatus for tannin as follows:

I. *Albumin.*—20 c.c. of the urine is filtered, and, if not yet perfectly clear, 0·5 c.c. of N/10 silver nitrate is added and the liquid refiltered; 12 c.c. of the clear urine is then introduced into a graduated tube, 8 c.c. of a 12·5 per cent. solution of trichloracetic acid added, the whole shaken five or six times, allowed to remain three minutes, and again similarly shaken. The liquid is then introduced into the Aglot apparatus and examined with the opal glass as usual. The thickness E in millimetres of liquid necessary to extinguish the light, multiplied by the quantity Q of albumin in grams per litre is a constant C, which is, under the above conditions, 8·2. Therefore $Q = 8·2/E$. The trichloracetic acid may be replaced by Esbach's solution, in which case the constant becomes 5·0.

II. *Uric acid.*—The urine to be tested is agitated strongly to bring the urates and free acid into suspension, 25 c.c. is rapidly measured and introduced into a flask, 0·3 gram of pure sodium carbonate is added, and the whole heated on a water-bath for a quarter of an hour to bring the uric acid and urates into solution. After cooling and filtering, 20 c.c. of this liquid is measured into a flask, 10 c.c. of a solution of copper thiosulphate added, and the mixture left for five minutes. It is then introduced into the Aglot apparatus and tested. In this case, the constant is equal to 5·6, and the quantity of uric acid in grams per litre is equal to 5·6/E. The copper thiosulphate being very unstable must be prepared as needed from the following three stable solutions. A, 40 grams of Rochelle salt, 20 grams of sodium thiosulphate and water to 250 c.c. B, copper sulphate 3·5 grams and water to 250 c.c. C, syrup of glucose of 36°. 3 c.c. of A, 7 c.c. B and 10 c.c. of C are mixed together.

Very accurate results are obtained and the two estimations may be performed in about half an hour. L. T. T.

Analysis of India-rubber. By Robert Henriques (*Chem. Zeit.*, 1894, **18**, 905—906).—The author, in reply to Terry (*Jour. Soc. Chem., Ind.*, 1892, **11**, 972) and Lobry de Bruyn, states that an appreciable loss of india-rubber is caused by the solubility of the same in alcoholic alkali. The alcohol should therefore always be expelled and the residue treated with water (Abstr., 1893, ii, 399). L. de K.

Analysis of Rubber Goods. By Carl O. Weber (*Chem. Zeit.*, 1894, **18**, 1003—1005; 1040—1041; 1064—1069).—The author has given an interesting process for the analysis of rubber goods. It may be briefly described as follows:—The finely-divided sample is first treated with acetone which dissolves fatty and sulphurised oils, mineral oils, rosin oil, natural and added resins, paraffins, free, and in part, combined sulphur. The residue is exhausted with boiling alcoholic soda which dissolves *faktis* and any sulphur or chlorine contained therein. After drying, the mass is extracted with cold nitrobenzene which dissolves asphalt and any sulphur therein contained. The extraction is then repeated with boiling nitrobenzene which dissolves the rubber and any vulcanising sulphur. After this, the residue is boiled with water and the solution tested for starch, whilst the insoluble matters will now consist of the mineral matter with any lamp-black and a little sulphur. As it is not practicable to recover the dissolved matter from the alcoholic soda or the nitrobenzene, the insoluble matter must each time be weighed. The adhering nitrobenzene may be easily removed by washing with benzene.

The author also gives a delicate test for the presence of red lead. The finely-ground sample is moistened with a solution of aluminium chloride in ether and then heated in an air bath for two hours at 120°. If red lead is present the rubber becomes hard and brittle and emits an odour of chlorine. L. DE K.

Densimetric Estimation of Proteïd. By THEODOR LOHNSTEIN (*Pflüger's Archiv*, 1895, **59**, 479—507).—The estimation of proteïd, especially in urine, by observations on the specific gravity before and after the removal of the proteïd, has been the subject of numerous previous researches. The first part of the present paper is a discussion of these methods, especially that of Huppert and Zahor (Abstr., 1888, 1226). The subject is discussed in its mathematical bearings, and the object aimed at, a constant factor, can be arrived at by employing another substance in solution in addition to the albumin, and observing the sp. gr. after the removal of one and both. The second part of the paper suggests a new densimetric method, and shows that good results are obtained by its use. The proposed method is briefly this: The volume v of a concentrated solution of sodium hydroxide is brought to the volume V by dilution with distilled water; the proteïd solution contains p grams of albumin per 100 c.c.; of this solution a volume equal to V is taken, and the proteïd precipitated; the coagulum is well washed and dissolved in v c.c. of undiluted sodium hydroxide, with heat if necessary; this is diluted up to V. The sp. gr. of the sodium hydroxide solution is noted, and that of the one containing alkali albumin; the two solutions differ by $\frac{p}{100}$ V gram proteïd.

If s_1 = the sp. gr. of the sodium hydroxide solution, and s_2 that of the sodium hydroxide solution of albumin, then

$$s_2 = s_1 + \beta p,$$

and

$$p = \frac{1}{\beta}(s_2 - s_1).$$

For the method of estimating the coefficient $1/\beta$ the original paper must be consulted; its mean value is given as 402·45.

W. D. H.

Analysis of Seeds. By ERNST SCHULZE (*Chem. Zeit.*, 1894, **18**, 799—802).—The author points out the great difficulties connected with the analysis of plants and seeds. The chief part of the paper is, however, devoted to an attack on the process recommended by v. Asbóth (Abstr., 1894, ii, 127), at least when the same is applied to the analysis of seeds.

A sample of vetch seed which, according to v. Asbóth, should have yielded 5·35 per cent. of asparagine and 52·67 per cent. of starch calculated on dry substance, only gave 0·42—0·33 per cent. of asparagine and 36·3 per cent. of starch when tested respectively by Sachsse's and Märcker's processes. L. DE K.

General and Physical Chemistry.

New Formula for Specific and Molecular Refraction. By W. F. Edwards (*Amer. Chem. J.*, 1894, **16**, 625—634).—Taking the well-known equation for the index of refraction

$$M = \frac{\sin i}{\sin r} = \frac{V}{V_1},$$

where V is the velocity of light in the ether of space and V_1 is the velocity in the substance, then if A is the difference between V and V_1, we have $MV - MA = V$ or $(M - 1)V/M = A$. If the difference, A, is proportional to the amount of substance, and if we assume as the unit 1 gram of substance in 1 c.c., and that X is the retardation of velocity for unit substance,

$$X = \frac{(M - 1)V}{MD};$$

where M is the index of refraction and D is the specific gravity of the substance.

If there are several substances in a mixture for which

$$(M - 1)V/MD = C,$$

C being the retardation of V by the mixture, and $(m - 1)V/md = a$, $(m_1 - 1)V/m_1d_1 = b$, $(m_2 - 1)V/m_2d_2 = c$, &c., are the corresponding equations for the components, then $C = pa + p_1b + p_2c +$ &c., where $p + p_1 + p_2 +$ &c. $= 1$, and represent the percentage of the several components of the mixture. Since V is a factor of both members of the equation, it may be written in the form

$$\frac{(M - 1)}{MD} = \frac{p(m - 1)}{md} + \frac{p_1(m_1 - 1)}{m_1d_1} + \frac{p_2(m_2 - 1)}{m_2d_2} + \text{\&c.}$$

Tables are given showing that there is sufficient experimental verification to warrant further work with this formula. H. C.

Spectrophotometric Researches on Iodine Solutions. By Edmund Thiele (*Zeit. physikal. Chem.*, 1895, **16**, 147—155).—In many solutions changes in the absorption coefficients occur on dilution, and are explained by the assumption of dissociation. This explanation is not applicable to solutions of iodine, on which therefore the author undertook spectrophotometric observations, using for the purpose Krüss' apparatus. Solutions in carbon bisulphide, acetic acid, benzene, and paraldehyde were examined. In all, the absorption coefficient falls with dilution, increasing rapidly again, however, with the two latter solvents when a dilution of about 0·0001 is reached. Experiments were next performed to test the constancy of the absorption band. No movement of the band is produced on dilution, although the intensity of the absorption is altered. It appears probable, therefore, that dilution causes no alteration of the molecular weight of the iodine, but that the amplitude of the oscillation is changed. L. M. J.

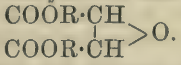
Spectrochemistry of Nitrogen. By JULIUS W. BRÜHL (*Zeit. physikal. Chem.*, **16**, 193—225, 226—241).—The atomic refraction of nitrogen was shown by the author (Abstr., 1893, ii, 254) to vary in its different classes of compounds, and he has therefore endeavoured to obtain, as completely as possible, the refractive data of nitrogenous compounds. A spectrometer and a Pulfrich total-reflectometer were employed for the purpose, and with them 132 compounds were examined; the source of each, its treatment, and the physical constants necessary to indicate its purity are given, and a table of the results of the observations is appended. From them, the author draws the following conclusions.

"Saturation isomerides" do not exhibit equal refractive or dispersive powers. In nitro-compounds, the specific refraction and dispersion is less than in the isomeric nitrites, whilst the index of refraction, the boiling point, and the density are greater. The refractive constants of the pyridine derivatives are smaller than those of the aromatic isomerides, the same relation obtaining between the pyrazines and aromatic hydrazines. The triple linkage ($C{\vdots}N$) is in its effect on the refractive and dispersive powers equivalent to two double linkages ($C{:}N$). A saturated heterocyclic nitrogen compound possesses a higher boiling point, density, and index of refraction, but smaller specific refraction and dispersion than its isomeric olefine derivative.

In the case of "position isomerides" the differences are not so marked. The aldoximes and ketoximes exhibit no differences. In cyclic compounds, those in which the nitrogen is united indirectly to the nucleus have their constants greater than those in which the union is direct. The specific refraction also is greater, the boiling point, density, and index of refraction less, the greater the number of carbon atoms directly united to the nitrogen; the tertiary amines therefore possess the highest constants in a series of isomeric primary, secondary, and tertiary amines. L. M. J.

Rotatory Power of Dissolved Substances. By P. FREUNDLER (*Bull. Soc. Chim.*, 1894, [3], **11**, 477—480; compare this vol., i, 174, 210, and 267).—It is becoming more and more evident that solvents which affect the specific rotatory power of a dissolved substance also affect its cryoscopic properties; and that, conversely, when the specific rotatory power of a substance is not affected by the solvent, its cryoscopic properties are normal. The alkylic acidyltartrates and valerates, and certain amylic ethers, afford evidence of the truth of the first part of the statement, whilst fresh evidence in favour of the second part is afforded by isobutylic amylic ether, which gives normal cryoscopic results in benzene solution, and the specific rotatory power of which, $[\alpha]_D = +1{\cdot}3°$, remains practically unaltered by that solvent: $[\alpha]_D = +1{\cdot}4°$. With regard to Ostwald's adverse criticism of the author's cryoscopic observations on benzene solutions, these have been repeated and extended, with the result of confirming the statement that the values in the cases questioned are below the normal.

The particular question of the connection between polarimetric and cryoscopic anomalies forms part of the broader question of the dependence of the physical properties of solutions on the state of molecular aggregation of the dissolved substance, as illustrated, for example, by Šule's work (Abstr., 1894, ii, 227) on the connection between the polarimetric and ebullioscopic constants of alcoholic and aqueous solutions of rhamnose.

Biot's original generalisation that the specific rotatory power of solutions is independent of the solvent and of concentration, provided there is no chemical action between the active substance and solvent, may still be regarded as true, if it be granted that the apparently anomalous substances either themselves undergo dissociation, or form molecular compounds with the solvent which are capable of dissociation. Aignan and Wyrouboff, in particular, have isolated compounds of the latter class; as regards the former class, the alkylic acidyltartrates, the specific rotatory powers of which have been shown to approximate steadily to that of the pure substance as the concentration is increased, may, possibly, undergo a peculiar kind of dissociation into acid anhydrides and derivatives of ethylenic oxide of the general formula  $\begin{matrix} COOR{\cdot}CH \\ COOR{\cdot}CH \end{matrix}\!\!>\!O$. In support of this hypothesis, it is to be observed that the benzene solution of methylic diacetyltartrate is acid to litmus, whereas the substance itself is neutral. Should this prove true, it will be possible, by making measurements at two different concentrations, to determine whether the specific rotatory power of a solution is or is not that of the substance itself. JN. W.

Ethereal Tartrates. By PHILLIPE A. GUYE and J. FAYOLLAT (*Compt. rend.*, 1895, **120**, 157—160).—The authors have determined the optical rotation of some ethereal tartrates of the general formula $C_2H_2(OH)(OA)(COOR)_2$, where A is some acid radicle. Their results are given in the following table.

	$[\alpha]_D$.		$[\alpha]_D$.
Ethyl tartrate	+5·25	Isobutyl tartrate...........	+11·8
,, monoacetyltartrate ...	+2·4	,, monoacetyltartrate .	+ 7·8
,, monopropionyltartrate	+2·3	,, monobutyryltartrate	+ 9·7
,, monobutyryltartrate ..	+1·8	,, monobenzoyltartrate	+11·5
,, monobenzoyltartrate ..	+1·5		

These results are shown to be in accordance with Guye's general theory of the rotatory power of homologous substances (Abstr., 1893, ii, 561). H. C.

Superposition of the Optical Effects of different Asymmetrical Carbon Atoms in the same active Molecule. By PHILLIPE A. GUYE and M. GAUTIER (*Compt. rend.*, 1894, **119**, 953—955).—The authors have previously shown (this vol., ii, 149) that the two similarly asymmetrical carbon atoms in amylic ether each act on polarised light as if the remainder of the molecule were inactive, the observed effect being the algebraic sum of their separate effects. Experiments with amylic valerate and amylic amylglycollate show that this is also true when the two asymmetrical carbon atoms are associated with dissimilar instead of similar groupings. According to this view, the optical rotation caused by the amylic valerate (1) $CHMeEt\cdot CH_2\cdot O\cdot CO\cdot CHMeEt$ should be approximately equal to the sum of the rotations produced by the amylic valerate (2)

$$CHMe_2\cdot CH_2\cdot CH_2\cdot O\cdot CO\cdot CHMeEt,$$

in which there is only one asymmetrical carbon atom (in the valeric acid), and the valerate (3) $CHMeEt\cdot CH_2\cdot O\cdot CO\cdot CH_2\cdot CH_2\cdot CH_2Me$, in which there is also only one asymmetrical carbon atom, belonging, however, to the amyl radicle.

The third compound has recently been described (this vol., i, 202); a column 500 mm. long has a rotatory power = +1·08°. The second salt is obtained by the interaction of active valeric acid and inactive isoamylic alcohol; its rotatory power for a column 500 mm. long is +4·26°. The sum of the two values is +5·34°.

Amylic valerate was prepared by the interaction of active valeric acid and racemised amylic alcohol, and also by the interaction of racemised valeric acid and active amylic alcohol; the rotation of the first product was +4·40° and of the second +1·22°. The ethereal salts thus obtained are mixtures of two salts which cannot be separated by fractional distillation, but it is clear that they should behave towards polarised light as if the effect of one of the asymmetrical carbon atoms was neutralised in the first case, and the effect of the other in the second case. The sum of the two observed rotations is +5·62°.

The amylic valerate (1) was prepared by the interaction of active valeric acid and active amylic alcohol; its rotatory power in a column 500 mm. long is +5·32°, and this agrees fairly well with the two values +5·34° and +5·62° obtained by the indirect methods.

The results obtained with amylic amylglycollate will be described subsequently. C. H. B.

Magnetic Rotation of Solutions of Hydrogen Chloride. By OTTO SCHÖNROCK (*Zeit. physikal. Chem.*, 1895, **16**, 29—44).—The magnetic rotation of hydrogen chloride in aqueous solution, according to the observations of Perkin (*Trans.*, 1889, 680; 1894, 20), is double that of its solution in isoamylic ether, and the cause has been ascribed to the electrolytic dissociation in the former solvent. The author had previously found an equal rotation in the two solvents (Abstr., 1893, ii, 443), and has therefore carefully repeated and extended his researches. Solutions of the gas in water, isoamylic ether, isoamylic alcohol, ethylic alcohol, and in mixtures of these compounds were examined. The rotations of the solvents were first obtained and then those of the solution, 25 liquids being so treated. The rotation is taken from the mean of four or five separate results, and is given in thousandths of a minute.*

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* An unnecessary refinement, however, as the separate results under similar conditions differ in many cases by nearly a minute.

The results may be summarised by a table; values due to Perkin being added and marked *; the first column for each solvent giving concentration, the second the molecular rotation.

Water.		Amylic ether.		Amylic alcohol.		Ethylic alcohol.	
11·45	4·774	0·76	4·036	1·58	5·413	6·59	4·491
25·06	4·404	2·34	2·838	6·89	4·028	9·78	4·201
*15·63	4·419	3·45	3·322	9·49	3·809	14·64	4·232
*25·60	4·405	8·96	2·101	*25·45	3·285	*40·04	3·365

The rotation decreases with increasing concentration not only in aqueous solutions, but in those of other solvents; hence the author considers that dissociation has no effect on the magnetic rotation of solutions. L. M. J.

Electrical Potentials in a Liquid Conductor in Uniform Movement. By G. Gouré de Villemontée (*Compt. rend.*, 1894, **119**, 1201, 1202).—Mercury, and solutions of zinc, copper, and nickel sulphates containing 10 grams of the salt per litre, were caused to move through insulated horizontal or vertical glass tubes, of uniform bore, the diameter being 3 mm. for mercury and 8 mm. for the saline solutions, and observations were made with a view to detect differences of potential between two points in the liquid. The capillary electrometer used would indicate a difference of 0·00015 volt. The electrodes consisted of platinum wires, the ends of which were coated with an electrolytic deposit of the metal contained in the saline solution. Sometimes both electrodes were in the path of the moving liquid, sometimes one was in the moving liquid and the other in the reservoir. The rate of movement of the liquids was 33·5 mm. per second in the horizontal tubes and 155·3 to 323 mm. in the vertical tubes.

The results show that the uniform movement of a liquid conductor along wide insulated glass tubes of uniform section produces no appreciable difference of potential between two points in the liquid within the limits of velocity specified. C. H. B.

Measurement of the Specific Inductive Capacities of Water, Alcohol, &c. By Reginald A. Fessenden (*Phil. Mag.*, 1894, [5], **38**, 567—568).—It has hitherto been accepted that the high values for the specific inductive capacities for water, alcohol, and some other similar liquids which have been obtained by various experimenters are correct. If this were so, Maxwell's rule for the relation between specific inductive capacity and the index of refraction would not hold in these cases, and the phenomena of dispersion, &c., have been called in to explain this anomaly. The author finds, however, from the results of experiments described in the paper, that these high values are not correct, but that the true values are in every one of these substances very nearly equal to those called for by the theory.

The cause of the errors lies in the fact that electrolysis gives a capacity effect. It is for this reason that Kohlrausch's method almost always gives erroneous results, as what is measured is not the resistance of the electrolyte, but its impedance. H. C.

Thermodynamics of Galvanic Polarisation. By HANS JAHN and OTTO SCHÖNROCK (*Zeit. physikal. Chem.*, 1895, **16**, 45—71).—The authors develop, from the thermodynamical standpoint, formulæ for the cathodic, anodic and total polarisation for a solution. From these it is indicated that if the potential difference between a metal and its solution be subtracted from the total polarisation, the difference should be constant in the case of the strong oxy-acids, a result agreeing with experimental data. The E.M.F.s of various chains are also calculated and compared with the found results. Under similar conditions, all oxy-acids should show the same potential difference at the commencement of the gas development, a result experimentally obtained by Le Blanc. The polarisation should be independent of the concentration, and experiments with sulphuric acid gave the following results : normal solution 2·3977 volts, decinormal solution 2·3922. The nature of the electrode affects the polarisation ; the size, however, should not affect the final value. In the case of salt solutions, similar laws obtain, the polarisation increasing with the polarising E.M.F. and being independent of the concentration. The polarisation of dilute solutions of bases should be equal to that of dilute acids, and this conclusion is verified by experiments with solutions of potassium and sodium hydroxides, ammonia, ethylamine, and diethylamine. L. M. J.

Rôle of Atomic Heat in the Periodic Series of the Elements. By CHARLES T. BLANSHARD (*Phil. Mag.*, 1895, [5], **39**, 106—115).—The author sets forth a number of relationships deduced from a study of the latest and most accurate data for atomic heats and melting points. The atomic heat is found to decrease in any series from the monad to the tetrad element, and then increases till a maximum is reached with the heptad element. The variation is greatest with elements of low atomic weights, becoming less and less as the atomic weight increases. In Groups I and II (the metallic groups), as the atomic weight increases, both the melting point and the atomic heat decrease. In Groups III and IV (intermediate groups), as in all the sub-groups of the periodic system, the atomic heat increases with the atomic weight, whilst the melting point decreases : the former being characteristic of the non-metals, the latter of the metals. In Groups V, VI, and VII (non-metallic groups), as the atomic weight increases so do both atomic heat and melting point. In Group VIII, the melting point increases with the atomic weight, whilst the atomic heat decreases : the former being a non-metallic, the latter a metallic characteristic.

A table is also given of the volume heats (= atomic heat ÷ atomic volume) of the elements, the specific gravities being taken at 0° and the specific heats as near 15° as possible. In each natural group of elements, volume heat varies inversely as atomic volume. The variations become less and less as the valency for oxygen rises, until the seventh group is reached, when it becomes constant. As atomic heat increases in some groups and decreases in others with increase of atomic weight, whilst atomic volume regularly increases, it is evident that the increase in atomic volume proceeds at a higher ratio than the variation in atomic heat. Atomic weight being a constant increment, it follows from the above that in any natural group specific gravity varies more than specific heat. H. C.

Specific Heat of Metallic Tungsten. By A. W. GRODSPEED and EDGAR F. SMITH (*Zeit. anorg. Chem.*, 1895, **8**, 207—212).—The method employed by the authors is that described by J. Joly (*Roy. Soc. Proc.*, 1886, **41**, 248 and 352). Full details are given in the original paper. The mean of the results obtained is specific heat = 0·03380, with a probable error of ±0·0003. When this number is multiplied by the value for the atomic weight of tungsten obtained by Smith and Pennington (this vol., ii, 230), we get 184·921 × 0·0338 = 6·25, and, taking the value obtained by Smith and Desi (this vol., ii, 231), 184·704 × 0·0338 = 6·243. E. C. R.

Specific Heats of Gases. By H. PETRINI (*Zeit. physikal. Chem.*, 1895, **16**, 97—117).—The difference between the capacities for heat at constant pressure and at constant volume for gram molecules of the gas is nearly equal to 2 ($C_p - C_v = 1·98$). If the ratio of the specific heats c_p/c_v is given by the expression $1 + \frac{2}{2n + 1}$, where n is the number of atoms in the molecule, we obtain the results $C_v = (2n + 1) \times 0·99$, $c_v = C_v/A$, and $c_p = c_v + 1·98/A$, where A = the molecular weight of the gas. A very complete table of the known gaseous specific heats is given, with the results as calculated above. In general, the law $c_p/c_v = 1 + \frac{2}{2n + 1}$ is seen to hold. The chief exceptions are carbon bisulphide and sulphurous anhydride (in which the calculated value for c_p/c_v is too small), ammonia, methane, and ethylene (where this ratio is too great), and compounds which contain more than one atom of a halogen. The author considers that the exception in the case of carbon bisulphide may be ascribed to polymerisation, and in the halogen compounds to dissociation. The influence of temperature on the specific heat is considered; a marked increase in c_p, occurring with rise of temperature in the case of ammonia, methane, and ethylene. An expression for the dissociation is also obtained, and compared with experimental data.

L. M. J.

Influence of Temperature on the Specific Heat of Aniline. By ERNEST H. GRIFFITHS (*Phil. Mag.*, 1895, [5], **39**, 47—77 and 143—144).—In addition to the fact that our knowledge of its capacity for heat at different temperatures is far from satisfactory, water is, for other reasons, by no means an ideal standard for calorimetry. Its capacity for heat is so great that the changes in temperature caused by the immersion in it of bodies whose specific heats are small are too minute to be measured with exactness under ordinary circumstances. What is required is a liquid of small capacity for heat, whose temperature coefficient of specific heat is accurately known, easily obtainable in a fairly pure state, and having a low vapour pressure at ordinary temperatures. The author believes that aniline is a liquid fulfilling these conditions, and, in order to furnish data necessary for its successful use, has determined its specific heat over a range of 15° to 52°.

The method adopted, of which all necessary details are given in the paper, was to supply heat to the interior of the calorimeter by means of an immersed conductor, whose ends were kept at a constant potential difference. The following formula gives the specific heat curve between the limits of temperature already named.

$$S_1 = 0{\cdot}5156 + (\theta_1 - 20) \times 0{\cdot}0004 + (\theta_1 - 20)^2 \times 0{\cdot}000002.$$

The following table gives the experimental results and those obtained from the above formula.

θ_1.	S_1 obs.	S_1 cal.
15°	0·5137	0·5137
20	0·5155	0·5156
25	0·5175	0·5176
30	0·5198	0·5198
35	0·5221	0·5221
40	0·5244	0·5244
45	0·5268	0·5269
50	0·5294	0·5294
52	0·5304	0·5305

H. C.

Critical Temperature as a Test of the Purity of Liquids. By Raoul Pictet and Michael Altschul (*Zeit. physikal. Chem.*, 1895, **16**, 26—28, and *Compt. rend.*, 1895, **120**, 43—46).—The critical point of a liquid is altered to a much greater extent than the boiling point by the presence of impurities, and hence the direct determination of the critical temperature affords a valuable indication as to the purity of the liquid.

The liquid is placed in a glass tube about 50 mm. long and 3 mm. internal diameter, with walls about 1 mm. thick, and is then boiled to expel all traces of air, the tube being hermetically sealed. It should be about one-third full of liquid, and the remainder is, of course, filled with saturated vapour. These tubes are then heated in a jacket consisting of two concentric cylinders of wire gauze, with two windows of mica to allow of the examination of the tube. There is an outer layer of asbestos, and below the cylinders are several sheets of wire gauze to distribute uniformly the current of hot air from the burner. A thermometer is fastened to the glass tube. The temperature is observed when the meniscus disappears, or when the characteristic mist forms in the tube.

Quantities of alcohol in chloroform or ethylic chloride, or of acetaldehyde in valeraldehyde, alter the critical temperature by 1·7° to 6·0°, whilst the corresponding alterations in the boiling points are only 0·1° to 0·6°.

The change in the critical temperature is always in the same direction as the change in the boiling point. Ethylic alcohol reduces the boiling point and critical temperature of chloroform, but raises the boiling point and critical temperature of ethylic chloride.

C. H. B.

Critical Temperature of Liquids holding Solids in Solution. By Raoul Pictet (*Compt. rend.*, 1895, **120**, 64—67).—The observations were made in the manner previously described (preceding abstract). Ether was mixed with borneol, cineol, terpineol, phenol, guaiacol, and iodine, in the proportion, as a rule, of 1 part of the solid to 50 parts of ether.

With 0·5 gram of borneol and 25 grams of ether, the boiling point is raised by 0·2°, but the critical point by 8°, the critical temperature of the solution being 197°. At this point, the meniscus completely disappears, but there is no deposit of borneol, which remains gaseous in the ether vapour, although its melting point is 198°. At the ordinary pressure, borneol is not volatile in ether vapour. Even with 45 grams of borneol and 55 grams of ether, the critical point being 296°, the whole of the borneol remains at this temperature dissolved in the ether vapour.

A precisely similar result is obtained with borneol and ethylic chloride, the critical temperature being 181°, and with ether and guaiacol, iodine, or phenol. In all cases there is a rise in the boiling point of 0·1° to 0·3°, but a rise in the critical temperature of 4° to 12°.

A solution of alizarin in ethylic alcohol shows the same phenomenon; at the critical temperature, 240°, the alizarin remains completely dissolved in the alcohol vapour, although the temperature is 50° below its melting point (290°).

In 1877 the author suggested that the liquefaction of vapour takes place in two distinct phases: one at temperatures above the critical point, in a number of points in the midst of the vapour, the number being proportional to the pressure; the other below the critical point, under the pressure of the saturated vapour. Only in the second case does gravity intervene and produce permanent drops. In the first case, the existence of the vesicle is so brief that it evaporates almost as soon as it is formed, and is replaced by another in its immediate neighbourhood. These small, liquid spheres never form a drop or a meniscus visible to the eye; permanent liquefaction can, in fact, only take place below the critical temperature. Adopting this view, it is clear that solid bodies might dissolve in the aggregate of liquid vesicles suspended in the same vapour under high pressure and near the critical temperature. If this explanation is correct, it follows that the solids will be deposited if the vapour is superheated, owing to the rapid volatilisation of the vesicles. Should no such deposition take place, it will follow that, contrary to all laws concerning changes of state, solid bodies can become gaseous and mix with other gases at temperatures much below their melting points, and under considerable pressures from their own vapours. C. H. B.

Note by Abstractor.—The fact that many solids dissolved in liquids remain dissolved or diffused in the vapours of the liquids at, and even above, the critical temperature of the latter, although this temperature may be below the melting point of the solid, was observed by J. B. Hannay and J. Hogarth in 1880 (Abstr., 1880, 210—211 and 693), and they state that, in the case of potassium iodide and alcohol, no deposition of the solid occurs at temperatures much above the critical point. Ramsay was unable to confirm this result with potassium iodide in alcohol. Hannay and Hogarth state (*loc. cit.*) that when a red-hot iron is brought near one side of the tube containing the gaseous solution, there is deposition of the solid on that part of the tube which is thus heated, but the deposit redissolves when the local disturbance of temperature is removed. This would seem to confirm Pictet's explanation. (See also Hannay and Hogarth, *Roy. Soc. Proc.*, **30**, 178—188 and 484—490, and W. Ramsay, *ibid.*, **30**, 323—329, and **31**, 194—206.) C. H. B.

Heat of Combination of Water of Crystallisation of Organic Compounds. By W. J. Jorissen and E. van de Stadt (*J. pr. Chem.*, 1895, [2], **51**, 102—106).—The heat of combination of liquid water with the solid substance to form the solid hydrate can be determined for organic substances which contain water of crystallisation in three ways: from the vapour tension, from the heat of solution, and from the heat of combustion. The authors have compared the numbers obtained by the last two of these methods for a series of compounds, the data being partly taken from previous determinations and partly from their own experiments, and have found on the whole a satisfactory agreement.

	From heat of solution.	From heat of combustion.
Citric acid ($1H_2O$)	2·61	3·2
Racemic acid ($1H_2O$)	1·48	(1·2)
Creatine ($1H_2O$)	3·5	6·7
Milk sugar ($1H_2O$)	6·16	6·2
Oxalic acid ($2H_2O$)	6·3	7·4
Raffinose ($5H_2O$)	17·9	6·8

A. H.

Thermal Properties of Nitrobenzoic acids. By Gustave Massol (*Bull. Soc. Chim.*, 1894, [3], **11**, 560—562).—The heats of dissolution of these acids, calculated from the heats of dissolution in aqueous soda, are for the ortho-acid, +9·45 Cal.; for the meta-acid, +7·15 Cal.; and, for the para-acid, +6·20 Cal. The heats of dissolution of the anhydrous sodium salts are +0·31 Cal., −1·03 Cal., and −1·90 Cal. respectively. The heats of formation of these salts, calculated from the above data, are +20·39 Cal., +19·39 Cal., and +19·31 Cal. respectively. The heat of formation of sodium benzoate being +17·4 Cal., it follows that the augmentation of the heat of formation caused by the nitro-group diminishes with its distance from the carboxyl, a result similar to that obtained with the phthalates. Comparing the heats of formation of sodium benzoate, +17·4 Cal.; salicylate, +19·15 Cal.; orthonitrobenzoate, +20·39 Cal.; and phthalate, +22·12 × 2 Cal., it is seen that carboxyl is more negative than the nitro-group, and this, in turn, than the hydroxyl group. Jn. W.

Influence of the Relative Volumes of Liquid and Vapour on the Vapour Pressure of a Liquid at Constant Temperature. By SYDNEY YOUNG (*Phil. Mag.*, 1894, [5], **38**, 569—572).—It has been stated by Batelli that when, in a tube containing a perfectly pure liquid and its vapour, the volume is diminished and the vapour caused to condense, the vapour pressure rises; in other words, that the smaller the relative volume of vapour, the higher is the vapour pressure. The author has recently been engaged in determining the vapour pressures of isopentane (b. p. 28°) at various temperatures, and in many cases the volumes of liquid and vapour were read. The results, some of which are given in full in the paper, prove conclusively that the vapour pressures of isopentane are independent of the relative volumes of liquid and vapour.

If, however, a trace of air happens to have entered the tube, or to have been left in the liquid, or a small quantity of permanent gas has been formed by partial decomposition of the liquid by prolonged heating at high temperatures, the presence of permanent gas (or of very volatile impurity) is clearly indicated by the increase of pressure required for the complete condensation of the vapour. The following points have been noticed in such cases:—(1) The pressure does rise as the volume of vapour diminishes; (2) the readings taken with diminishing volumes are higher than with increasing volumes.

H. C.

The Relation between Dissociation and Temperature. By HANS JAHN and E. SCHRÖDER (*Zeit. physikal. Chem.*, 1895, **16**, 72—90).—Determinations were made by Kohlrausch's method of the conductivity of aqueous solutions of formic, acetic, propionic, butyric, isobutyric, and valeric acids. Each acid was employed in $\frac{1}{1}$, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$, $\frac{1}{128}$ normal solutions, and at a series of temperatures varying from 10° to 50°. The results at each concentration are expressed by an interpolation formula* which in all cases satisfactorily reproduces the observed numbers. The conductivity at infinite dilution is calculated from determinations with the sodium salts by the expression $\lambda_\infty = \lambda_{HCl} - \lambda_{NaCl} + \lambda_{NaR}$, and a temperature formula given. The constant $(\lambda_v/\lambda_\infty)^2/(1-\lambda_v/\lambda_\infty)$ is obtained at temperatures 10°, 20°, 30°, and 40°. The values are approximately constant, except for the higher concentrations, and vary but slightly with the temperature, so that the increase of conductivity with temperature appears to be chiefly due to the decrease of the ion friction. The heat of dissociation is also calculated for each of the first five acids at each dilution, the values being recorded in a table. They are in all cases negative and, as might be expected, very small.

L. M. J.

Certain Regularities in the Weights of Drops of Molten Metals. By ISIDOR TRAUBE (*Ber.*, 1895, **28**, 419).—Remarks on Thaddéeff's paper on this subject (this vol., ii, 161). C. F. B.

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* It appears noticeable that with each acid the interpolation formulæ are in all cases of the form $\lambda = a + bt - ct^2$, so that a maximum should occur at the temperature $b/2c$ if the expression were applicable to higher temperatures. This is in most of the experimental series about 80° to 120°, and at infinite dilution about 150° to 170°.

Volume Change on Neutralisation. By GUSTAV TAMMANN (*Zeit. physikal. Chem.*, 1895, **16**, 91—96 and 139—146).—In the first paper, the volume changes on neutralisation are recorded in the cases of a dilute solution of sodium hydroxide with hydrochloric, sulphuric, acetic, and monochloracetic acids. The determinations were made by the method of density observations with Sprengel's pyknometers. With the strong, completely dissociated acids, hydrochloric and nitric, the volume change alters but slightly with concentration—about 20 per cent. from 1·0 to 0·005 normal solutions. With sulphuric acid, the increase was about 90 per cent.; with monochloracetic acid 60 per cent., and with acetic acid 50 per cent.

In the second paper, the author endeavours to prove that the volume alteration is due to the effect of the altered internal pressure, and may be calculated from the compressibility coefficient and the change in internal pressure. Amagat's results supplying compressibility data, the author calculates the volume change at 20° in the case of the neutralisation of sodium and potassium hydroxides by hydrochloric acid, the calculated and observed results showing satisfactory agreement. Expressing the volume change in terms of the differences in internal pressure by an equation,

$$\Delta v = \mu \times 10^{-7} V[\tfrac{1}{2}(\Delta k_a + \Delta k_b) - \Delta k_s];$$

if the volume is V, the reciprocal of the concentration, then the product $V\Delta k$ should be independent of the concentration, and Δv should vary as μ. This is found to be the case by experiments with sodium hydroxide and hydrochloric acid. Similarly Δv should vary with the temperature in the same manner as μ, where Δk is independent of the temperature. In the case of water, μ decreases between 0° and 50° by about 14 per cent., increasing above this temperature. In 1/1000 solution of the above compounds, Δv changes from 20·9 at 0° to 18·7 at 30°, and from 100° to 140° increases 37 per cent., while μ between the same temperature increases 30 per cent. The calculated volume change, owing to decomposition of a binary electrolyte into its ions, is calculated as 9—10 c.c., the observed value for various electrolytes varying from 8 to 12 c.c. (gram equivalent per litre). L. M. J.

The Freezing Point of Liquid Mixtures. By RAOUL PICTET and MICHAEL ALTSCHUL (*Zeit. physikal. Chem.*, 1895, **16**, 18—23).—Two sets of aqueous solutions of alcohol were prepared, the first containing 1, 2, 3, &c., mols. of water per mol. of alcohol, the second containing 1, 2, 3, &c., per cent. of water. The results of the freezing point determinations are expressed by curves. The second curve is approximately a hyperbola; the first shows numerous breaks, and is made up of a number of straight lines with irregular joining portions. Some of these straight lines pass through the origin, but others do not; for example, the portions between 16·4 and 30 per cent., and between 39 and 65 per cent. The author hence considers that here the lowering is proportional to the quantity of some dissolved hydrate. A table is added of the freezing points from $C_2H_6O + 100OH_2$ (−1·0°) to $C_2H_6O + OH_2$ (−51·3°). L. M. J.

Maximum Depression of the Freezing Point of Mixtures. By EMANUELE PATERNÒ and CLEMENTE MONTEMARTINI (*Gazzetta*, **24**, ii, 208—222).—The authors have made a number of experiments on the depression of the freezing point of solvents by dissolved substances, using solutions containing from 0—10 per cent. of dissolved matter. It might be expected that the maximum depression of the freezing point of mixtures of two liquids would be obtained when the two substances were present in some simple molecular proportion. This was found to be the case in the several instances investigated; mixtures in the ratio of 1 mol. of paraxylene with 2 mols. of acetic acid, 1 of paraxylene with 2 of phenol or 3 of trimethylcarbinol, and 6 of phenol with 1 or 2 of trimethylcarbinol, have lower freezing points than any other mixtures of the two constituents. The maximum depression of the freezing point of paraxylene by benzene is obtained when about 1 mol. of each is present. W. J. P.

Cryoscopic Behaviour of Substances having Constitutions similar to that of the Solvent. By FELICE GARELLI and C. MONTANARI (*Gazzetta*, **24**, ii, 229—263).—Garelli (Abstr., 1894, i, 157) has shown that, in determining the molecular weight of a substance by the cryoscopic method, anomalous results are obtained if the solvent has a constitution similar to that of the substance dissolved; the cause of this behaviour was assigned to the formation of a solid solution of the two components, a view which is amply justified by the present series of cryoscopic determinations with a large number of pairs of substances.

Diphenylene oxide and coumarone, both of which contain the furfuranic nucleus, cause slightly anomalous depressions of the freezing points of phenanthrene and naphthalene respectively; the irregularity diminishes in degree as the number of benzenoid radicles present in the furfurane nucleus decreases, so that pyromucic acid depresses the freezing point of benzoic acid normally. β-Naphthaquinoline gives too high a molecular weight in phenanthrene, whilst phenanthroline gives the normal depression. Molecular weight determinations of toluene and isomethyleugenol in benzene solution show that the introduction of an aliphatic side chain into the benzene nucleus alters the configuration of the molecule to such an extent that normal results are obtained in benzene solution; such is not the case with phenols and aromatic amides, the molecular configuration of benzene is so slightly altered by the introduction of an hydroxyl or amidogen group that solid solutions are still obtained. Quinol is the only dihydroxybenzene which gives the theoretical depression in phenol solution, the depressions caused by its isomerides being too small.

Benzoic acid solutions of naphthalene, acetanilide, diphenylamine, resorcinol, and thymol were examined in order to determine the molecular depression of the freezing point; this was found to be 78·5. 2-Thiophenic, 2-pyrrolinecarboxylic, salicylic, and metahydroxybenzoic acids give high molecular weights in freezing benzoic acid, whilst pyromucic, parahydroxybenzoic, and the three amidobenzoic acids give almost normal values, the para-compounds being the most satisfactory in this respect. The behaviour of benzamide in benzoic acid solution is quite normal, so that the power of forming solid solutions is lost by the substitution in the side chain.

The molecular depression of the freezing point of acetophenone was found to be 56·4, from determinations made with naphthalene, nitrobenzene, bromobenzene, aniline, acetone, and salicylic and benzoic acids; this number differs considerably from 74·4, the constant deduced from Raoult's law. 2-Acetylpyrroline, 1-acetylpyrroline, and acetothiënone, which have constitutions somewhat similar to that of acetophenone, form solid solutions with it.

The molecular depression of the freezing point of succinic anhydride was found to be 63 from determinations made with isoapiole, acetanilide, and succinimide. With this solvent, maleïc anhydride forms isomorphous mixtures the melting points of which can be calculated by Küster's rule. Oleïc and palmitic acids give normal molecular weights in stearic acid solution.

The depression of the freezing point of crotonic acid by isocrotonic acid is normal, as would be expected from the dissimilarity in constitution of these two substances. Metanicotine is found to depress the freezing point of diphenyl normally, a result which favours the constitution assigned to the base by Pinner (Abstr., 1893, i, 736).

W. J. P.

The Freezing Points of Isomorphous Mixtures. By Felice Garelli (*Gazzetta*, **24**, ii, 263—274).—Küster has shown (Abstr., 1894, ii, 274) that if the composition of the solid matter which separates on cooling a melted mixture of two substances is the same as that of the liquid above it, the melting point of the mixture can be directly calculated from those of the components. The author now shows, in the case of mixtures of anthracene with phenanthrene, of carbazole with phenanthrene, and of carbazole with anthracene, that although the melting points of the mixtures are limited by those of their components, yet considerable differences exist between the melting points observed and those calculated by Küster's rule. No explanation of the anomalous behaviour of such mixtures is given by van't Hoff's theory of solid solutions. W. J. P

Reduction of the Freezing Point of Dilute Solutions of Sodium Chloride. By A. Ponsot (*Compt. rend.*, 1895, **120**, 317—319).—With the aid of the apparatus described in a former paper (Abstr., 1894, ii, 342), the author has determined the freezing points of dilute solutions of sodium chloride. For temperatures from 0° to $-1·5°$, a thermometer was used graduated to $\frac{1}{2000}°$, and for temperatures from $-0·5°$ to $-4°$ a thermometer graduated to $\frac{1}{600}°$. The molecular reductions are calculated, and the results compared with those of Jones, Arrhenius, Loomis, and Pickering. The values obtained for the molecular reductions are throughout lower than those of the other observers, and the reduction is proportional to the weight of salt contained in 100 grams of the solvent. Similar results were obtained with potassium chloride solutions. H. C.

The Freezing Points of some Organic Liquids. By Michael Altschul and B. v. Schneider (*Zeit. physikal. Chem.*, 1895, **16**, 24—25).—The authors have determined the freezing points of some organic liquids which only solidify at low temperatures. Their results gave:—Benzic chloride, −47·9°; benzylidene chloride, −17·0°; benzotrichloride, −17·0°; benzaldehyde, −13·5°; piperidine, −17°; quinoline, −19·5°; cinnamaldehyde, −7·5°; propionic acid, −24·5°; orthoxylene, −45·0°. The other liquids examined did not freeze at −100° or −80°. From these results, the authors consider that addition of a methyl group in the benzene nucleus lowers the freezing point, which is, however, raised by the substitution of chlorine for hydrogen, and that in isomeric compounds the iso-compound has the lower freezing point. L. M. J.

Paraxylene as the Solvent in Cryoscopic Investigations. By EMANUELE PATERNÒ and CLEMENTE MONTEMARTINI (*Gazzetta*, **24**, ii, 197—208).—The high freezing point of paraxylene (16°) would recommend it as a solvent in cryoscopic determinations; the authors have therefore made a number of trials with this hydrocarbon in order to ascertain its suitability for this purpose. The depressions of the freezing point of paraxylene by 24 hydrocarbons, organic salts, alkaloïds, alcohols, acids, and phenols were determined; the molecular depression, as calculated from the experiments with benzene, naphthalene, diphenyl, ethylic oxalate, thiophen, aniline, and tribenzylamine is 43·34. The constant calculated from Colson's determination of the latent heat of fusion is 42·5, and may be taken as 43 for practical purposes.

Paraxylene, when used as a solvent for cryoscopic determinations, behaves very similarly to benzene; normal molecular weights are obtained with hydrocarbons, ethers, anhydrides, alkaloïds, and neutral substances generally, whilst alcohols and phenols depress the freezing point abnormally, just as they do that of benzene. W. J. P.

Solubility Experiments. By ARTHUR A. NOYES and CHARLES G. ABBOT (*Zeit. physikal. Chem.*, 1895, **16**, 125—138).—When, to a saturated solution of a salt, a second salt containing one similar ion is added, the quantities of the dissolved compounds is calculable on the assumption that (i) the quantity of dissolved undissociated salt remains unchanged, and (ii) the product of the quantities of the two ions is still the same. The values obtained by experiment and calculation, however, have, as a rule, shown only approximate agreement, and doubts have been thrown on the validity of the above solubility laws (Abstr., 1893, ii, 364). The authors have therefore tested the law by a series of experiments on the solubility of the chloride, bromate, and thiocyanate of thallium. The salts were all prepared from the pure metal, and great pains taken to ensure their perfect purity. The solubility of each salt in water was determined, the three pairs of saturated solutions mixed, and the quantity of each salt in solution estimated. Then if m_0, m_0', m, and m' are solubilities of the two salts in the water and mixed solution, and a_0, a_0', a, a' their degree of dissociation, the equations obtain $m_0(1 - a_0) = m(1 - a)$; (2) $m_0'(1 - a_0') = m'(1 - a')$; (3) $m_0^2a_0^2 = ma(ma + m'a')$; $m_0^{2\prime}a_0^{2\prime} = m'a'(m'a' + ma)$. From these the constants a_0 are calculable. The value a_0 for each salt is thus obtained from two independent experiments, and the agreement of the values forms the test of the validity of the law. The results gave for $100a_0$:—thallium chloride, (1) 86·5, (2) 86·5; thallium thiocyanate, (1) 86·7, (2) 86·6; thallium bromate, (1) 89·9, (2) 91·1. The values, as calculated from conductivity experiments, were 86·6, 85·6, and 89·0. The solubility influence law is therefore, the authors consider, undoubtedly valid. L. M. J.

Some Properties of Calcium Chloride Solutions. Part I, Freezing Points; Part II, Heat of Dissolution; Part III, Densities, and Discussion of the Results. By SPENCER U. PICKERING (*Ber.*, 1893, **26**, 2766—2771; 1894, **27**, 67—75, 1379—1385).—The solutions examined ranged from a strength corresponding with the hexahydrate down to the weakest solutions possible. The results were examined critically with a view of ascertaining whether they all indicated changes of curvature at the same points. This was found to be the case, and drawings which showed these changes agreed well with the ascertained experimental error; whereas drawings obliterating these changes, or placing changes at other points, were found not to do so. The hydrates which were indicated as existing by all three properties were those with about 10, 13, 17, 29, and 1500 H_2O, but from the magnitude of the experimental error as compared with the smallness of the difference in strength corresponding with an additional molecule of water, it was impossible to say whether the changes occurred at simple molecular proportions or not. In all cases where changes were not indicated by all the properties alike, the evident cause was absence of sufficient experimental data in some of the series. The freezing points were extended somewhat beyond the strength corresponding with $CaCl_2,6H_2O$, and in this region either this hydrate or two distinct forms of a tetrahydrate may be made to crystallise from the same solution. The molecular depression of the freezing point of the hexahydrate by water is only 0·003° for H_2O to $100(CaCl_2,6H_2O)$, which is about one-seventieth of that given by van't Hoff's equation; it increases rapidly to 0·099° as the proportion of water present is increased. S. U. P.

A New Method for the Determination of Isosmotic Concentrations. By H. KÖPPE (*Zeit. physikal. Chem.*, **16**, 261—288).—A small graduated pipette with a funnel-shaped end is partially filled with blood, and the volume noted. A salt solution is then introduced and the liquids mixed, after which the ends are closed and the pipette placed in a centrifugal machine, by which means the corpuscles collect at the end of the pipette, and their volume is determined. Other circumstances being similar, namely, quality of blood, centrifugal force, &c., the ratio of the volume of the blood corpuscles to that of the blood itself depends on the osmotic pressure of the solution, decreasing as the osmotic pressure rises; it can hence be used as a measure of this constant. In all cases, the method is comparative, the salt solution being compared with a standard solution, usually potassium dichromate.

A number of experiments are recorded to determine a series of isosmotic solutions, and the relative concentrations are approximately equal to those of De Vries and Hamburger. The method is also tested by the use of solutions given by De Vries as isosmotic, when the ratios are found approximately equal. The values for the dissociation coefficients as obtained by this method are also compared for a number of salts with those due to Raoult, the agreement, however, being only approximate. The increase of dissociation by dilution can also be found by comparison with an undissociated compound, such as cane sugar. The influence of the plasma is considered, and the author points out that it is merely a diluent unless the salt examined is also present in the plasma. The paper concludes with various details as to the mode of use of the instrument.

L. M. J.

Mixed Crystals of the Chlorides of Cobalt and Manganese. By WILLEM STORTENBEKER (*Zeit. physikal. Chem.*, **16**, 250—261).—From solutions of the chlorides of cobalt and manganese containing 1 mol. of cobaltic chloride with from 0 to 5 mols. of manganous chloride mixed crystals can be obtained, red in colour and isomorphous with the hydrated chloride of cobalt, $CoCl_2 + 6H_2O$. If the solution contains more than 2 mols. of the manganese salt, violet mixed crystals form spontaneously, isomorphous with the chloride of manganese, $MnCl_2 + 4H_2O$. A series of experiments was made with solutions of various strengths, and the percentage of each constituent in both the solution and the crystals determined. At the temperature 15°, it is seen that complete equilibrium exists between the solution $CoCl_2 + 2MnCl_2 + 29H_2O$ and the solid phases $CoCl_2,6H_2O + 0{\cdot}59MnCl_2,6H_2O$, and $CoCl_2,4H_2O + 2{\cdot}9MnCl_2,4H_2O$. The results are also expressed by curves, which are completed to indicate the labile state. The results are also compared with the closely analogous case of the monoclinic and rhombic mixed crystals of the sulphates of iron and magnesium. L. M. J.

Method of Determining Molecular Weight and Constitution. By ISIDOR TRAUBE (*Ber.*, 1895, **28**, 410—413).—According to the author, the molecule of any substance dissolved in water exercises always the same attraction for the solvent, the contraction caused by this attraction being for the gram-molecule 12·2 c.c. In the case of electrolytes, this same contraction is produced by each gram-equivalent of the dissolved ions. The substance is here supposed to retain its original volume on passing into solution, and the contraction is regarded as taking place solely at the expense of the water. The difference, therefore, between the molecular volume of the homogeneous substance V_m and the molecular solution volume v_m (this vol., ii, 70) gives the contraction of the water in c.c. per gram-molecule dissolved. It is only in cases in which, in accordance with Ramsay and Shield's method of observation, it is necessary to assume association of the simple gaseous molecules in the liquid state, that the above difference varies to any great extent from 12·2 c.c., and in these cases the number obtained is invariably smaller, the limits being from 1·5 to 12 c.c.

The majority of the organic compounds, according to Ramsay and

Shield's results, are substances in which the association above spoken of does not take place, and which therefore may be regarded as behaving quite normally. With such compounds, the law that has been enunciated may be applied for the purpose of determining molecular weights; for the molecular weight will obviously be that quantity which, taken in grams, produces a contraction, or difference between the molecular volume and the molecular solution volume, of 12·2 c.c. on solution in water.

But the method may be simplified and rendered applicable even to substances insoluble in water. The molecular volume is, in the case of organic compounds, an additive function of the atomic volumes. Up to the present, a satisfactory agreement between the observed values and those calculated on the above assumption has certainly not been obtained, but this the author attributes to two causes. In the first place, no account has hitherto been taken of the association which sometimes takes place in the molecules of liquids, and which has already been spoken of; and, in the second place, it has always been assumed that the molecular volume really is equal to the sum of the volumes of the atoms, and that no change of volume occurs during the formation of the molecule. In the last case, a term would have to be introduced expressing this change of volume, A, and the formula for calculating the molecular volume from the atomic volumes for organic compounds would be

$$V_m = mV_aC + nV_aH + \ldots\ldots\ldots\ldots + A.$$

Now the author has found in the case of the molecular solution volume (*Zeit. anorg. Chem.*, 1895, **8**, 74) that the formation of the molecule from the atoms is always attended by an increase in the total volume. This increase is the same for all substances, both organic and inorganic. A is therefore positive, and for the molecular solution volume in aqueous solution has a mean value of 13·5, or for the molecular volume of 13·5 + 12·2 = 25·7. From this the following relationships will be found to hold at 15°.

$$\text{I. } v_m = m10C + n3{\cdot}05\,H + p1O' + q4O'' + r6O''' + 13{\cdot}5,$$

and

$$\text{II. } V_m = m10C + n3{\cdot}05\,H + p1O' + q4O'' + r6O''' + 25{\cdot}7.$$

O′ is hydroxyl oxygen, O″ carbonyl oxygen, and O‴ is ether oxygen, which in this, as in the case of the specific refraction, has a different value. For every benzene ring present, 12·8 units must be subtracted, but the influence of multiple linkages, if any, is so slight that it may be neglected.

With the aid of these formulæ, it is possible by means of a single sp. gr. determination to calculate the molecular weight of any organic compound the constitution of which is approximately known. From the sp. gr., the molecular volume is first calculated, and then, by means of formula I, the molecular solution volume which the substance would have in water. If a correct value has been chosen for the molecular weight, the difference between these two quantities will be approximately 12·2; if the value chosen is double that which it should be, the difference will be $2 \times 12{\cdot}2 + 13{\cdot}5 = 37{\cdot}9$; and if the value chosen is half the true value, the difference becomes $\frac{1}{2}(12{\cdot}2 - 13{\cdot}5) = -0{\cdot}7$. The molecular weight has therefore to be so chosen that the contraction per gram-molecule is 6 to 12·2 c.c.; if double the true molecular weight has been taken, a value from 25·5 to 37·9 may be expected; and with half the molecular weight, a value of −0·7 to −3·8. The author gives a table of values obtained from the sp. gr. determinations, for hydrocarbons of known molecular weight and of very different constitution, the numbers being all within the limits 12·2 ± 4.

Since generally the molecular solution volume in a concentrated solution in any organic solvent is equal to the molecular volume of the homogeneous substance, the molecular volume of a solid substance may be ascertained by making a sp. gr. determination of its concentrated solution in some suitable organic solvent. The method is therefore of the widest application, and, from the experimental point of view, is probably the simplest that has been proposed for the determination of molecular weights. H. C.

Chemical Equilibria as Temperature Functions. By JOSEPH E. TREVOR and FREDERICK L. KORTRIGHT (*Amer. Chem. J.*, 1894, **16**, 611—624).—The consideration that the only things of which we can take direct cognizance are manifestations of energy, and that the total energy of an isolated system remains constant in amount or, in other words, subsists, leads at once to the idea of the substantiality of energy and to the conception that all natural processes are in their ultimate nature energy transformations. This makes the equilibrium of any material system subject to the condition that a possible variation of any one of the forms of energy which it includes must be exactly compensated by the corresponding variation of the forms correlated with this one; the criterion of equilibrium being that the algebraic sum of the energy changes involved in a virtual displacement of the equilibrium must vanish. When this criterion is applied to the equilibrium between heat Q and work W, it furnishes the fundamental differential equation for the equilibria of thermodynamics, in the form

$$\Sigma dW = \frac{Q}{T} dT.$$

T representing the absolute temperature of the heat quantity Q. This equation contains the theory of all displaceable chemical equilibria, because such equilibria always involve heat, and some one or more entirely convertible forms of energy. There are two cases to be considered, the complete and the incomplete equilibria of the phase rule.

When n substances compose a chemical system of $n + 1$ heterogeneous phases, one of which is vapour, the equilibrium is a function of but one independent variable, and its equilibrium equation is

$$+ \frac{\rho}{T} dT = v dp,$$

or

$$RT\, d \log_e p - \frac{\rho_T}{T} dT = 0.$$

Here p is the equilibrium pressure at the temperature T, ρ is the total molecular heat of change, that is, the heat Q absorbed at constant volume plus RT the volume energy (normally) obtained, and R is the constant of the gas-equation $pv = \mathrm{RT}$. To get rid of the volume energy term, we subtract $\frac{d \log_e \mathrm{T}}{d\mathrm{T}} = \frac{1}{\mathrm{T}}$ from both members, and there results

$$\mathrm{RT}\delta \log_e \mathrm{K} - \frac{\mathrm{Q_T}}{\mathrm{T}} \delta\mathrm{T} = 0,$$

$\log_e$ K being the characteristic constant of the reaction isothermal.

When n independent components make up a system of less than $n + 1$ heterogeneous phases, the isothermal equilibrium of the system depends, to a greater or less degree, on the relative concentrations of its components, and the balance existing between the respective volume energies of the latter will be disturbed by a possible addition of heat. The sum of the virtual changes then becomes, for a final equilibrium,

$$(\Sigma v dp - \Sigma \mathrm{V} d\mathrm{P}) - \frac{\mathrm{Q_T}}{\mathrm{T}} d\mathrm{T} = 0.$$

P, V, p and v representing the partial pressures and molecular volumes of the originally reacting substances, and of those produced by the reaction respectively. The bracketed member of this equation becomes $\mathrm{RT}\delta \log_e \mathrm{K}$ on the elimination of the pressures, and the equation becomes identical with that obtained in the former case, representing therefore the effect of changes of temperature in displacing *all* types of chemical equilibrium under discussion. This equation is usually written in the form

$$\frac{\delta \log_e \mathrm{K}}{\delta \mathrm{T}} = \frac{\mathrm{Q_T}}{\mathrm{RT}^2}.$$

In integrating this equation, the heat of reaction is usually assumed to be constant over a very small range of temperature, but this procedure generally restricts its applications. The heat of reaction $\mathrm{Q_T}$ absorbed at the absolute temperature T, being the energy difference of the reacting systems, is that, $\mathrm{Q_0}$, at some arbitrarily selected standard temperature $\mathrm{T_0}$ increased for each degree by the excess of the total molecular heat of the system II, which is produced by the reaction over that of the original system I. In symbols

$$\mathrm{Q_T} = \mathrm{Q_0} + (c_{\mathrm{II}} - c_{\mathrm{I}})(\mathrm{T} - \mathrm{T_0}).$$

Making the assumption that the difference Δc of the specific heats is constant between wide temperature limits, we get on substitution of this value for $\mathrm{Q_T}$ and integration

$$\mathrm{Log}_e \frac{\mathrm{K_2}}{\mathrm{K_1}} = \frac{\mathrm{Q_0} - \mathrm{T_0}\Delta c}{\mathrm{R}} \left(\frac{1}{\mathrm{T_1}} - \frac{1}{\mathrm{T_2}}\right) + \frac{\Delta c}{\mathrm{R}} \log_e \frac{\mathrm{T_2}}{\mathrm{T_1}}.$$

Successful applications of this relationship are made in the calculation of the heat of vaporisation from the vapour pressure, in the case of water, and of the heat of dissociation of carbonic anhydride as a function of the temperature. In the latter case, it is shown that at about 3555° the value of Q, the heat of dissociation, passes through zero and changes its sign. H. C.

Reaction Velocity of Potassium Hypoiodite. By ALFRED SCHWICKER (*Zeit. physikal. Chem.*, **16**, 303—314).—By the interaction of iodine and potassium hydroxide, a mixture of potassium iodide and hypoiodite may be considered to be formed, the latter compound passing over into potassic iodate, $3KIO = KIO_3 + 2KI$. The author has determined the reaction velocity of this change under various conditions. The method consisted in the determination of the unchanged salt at fixed times from the commencement of the reaction, hydrogen potassium carbonate being added and the precipitated iodine titrated. The reaction being of the third order, the velocity should be given by the equation $dx/dt = k(A-x)^3$ leading on integration to $2A^2k = x(2A-x)/t(A-x)^2$ where A is the original quantity of hypoiodite, and x that after time t. In those experiments where the iodine was in excess, this expression does give a constant value, and hence the reaction, most probably, takes place as indicated by the above equation. When the potassium hydroxide is in excess, however, the value is not constant, but this condition is fulfilled by $A/t(A-x)$ indicating that the velocity is given by the equation $dx/dt = k(A-x)^2$ and that the reaction is hence of the *second* order. What the course of this reaction is, and what is the equation which represents it, are, however, left to future research. L. M. J.

Rate of Oxidation of Phosphorus, Sulphur and Aldehyde. By THOMAS EWAN (*Phil. Mag.*, 1894, [5], **38**, 505—536, and *Zeit. physikal. Chem.*, 1895, **16**, 315—343).—According to our present knowledge, the velocity with which a chemical change takes place is dependent on the concentrations of the substances taking part in the change, and the connection between the two is of such a nature that a greater concentration corresponds with a greater velocity. Under these circumstances, it is of great interest that in a number of instances oxygen gas appears to act, chemically, more vigorously, that is with greater velocity, when it is dilute than when it is more concentrated. The reaction between phosphorus and oxygen is of this character, and was selected by the author in the first place as a suitable one for the study of the connection between the velocity of the change and the concentration of the oxygen.

On the assumption that the rate of the reaction is proportional to the partial pressure of the oxygen, when the volume of the gas is kept constant, $-dp/dt = K'p$, where p is pressure, t time, and K′ a constant. If $p = p_0$ when $t = 0$, p_0 being the pressure of the oxygen at the beginning of the experiment, we get on integration

$$K' = \frac{1}{t} \log \frac{p_0}{p}.$$

It was found, however, that the velocity of the reaction in moist air diminishes a little more slowly than the partial pressure of the oxygen, the values of K′ increasing, and therefore that the reaction takes place somewhat faster at lower pressures than one would expect if its velocity were directly proportional to the pressure. This is probably due to the fact that substances evaporate more rapidly into a gaseous atmosphere when its pressure is small than when it is larger, and as there are reasons for supposing that the phosphorus vapour is oxidised as fast as it is evolved from the surface of the phosphorus, the velocity with which the reaction goes forward will be directly proportional to the rate of evaporation of the phosphorus.

According to Stefan, the rate of evaporation of a liquid into a gas, $v = c \log \mathrm{P}/(\mathrm{P} - p')$, where P is the total pressure of the gas and vapour, p' the vapour-pressure of the liquid and c some constant. Introducing this correction for the changeable velocity of evaporation into the equation already given, we obtain

$$-\frac{dp}{dt} = \mathrm{K}p \log \frac{\mathrm{P}}{\mathrm{P} - p'}.$$

To integrate this equation we may write $p = \mathrm{P} - a$, where a is the partial pressure of the nitrogen and aqueous vapour in the mixture of gases and therefore constant. Then without appreciable error,

$$\mathrm{K}t = \frac{\mathrm{P}_0 - \mathrm{P}}{p'} + \left(\log \frac{\mathrm{P}_0 - a}{\mathrm{P} - a}\right)\left[\frac{a}{p'} - \frac{1}{2}\right].$$

The values of K are more nearly constant than those of K′ when the partial pressure of the oxygen is from 50 to 150 mm. It appears therefore that the velocity of the reaction in these cases is proportional to the pressure of the moist oxygen. But since, when the pressure of the oxygen is greater than a certain limit, the velocity of the reaction becomes zero, this is not true for all pressures. Determinations of the limiting pressure, above which no reaction takes place, were only made at 20°, when a value of about 700 mm. was obtained. This corresponds with the value given by Joubert for the pressure at which phosphorus just begins to be luminous in oxygen at 20°. Therefore, above a certain limiting pressure (which probably varies with the temperature) the rate of action of moist oxygen on phosphorus is no longer proportional to the pressure of the gas, but is very much slower.

In the action of dried oxygen on phosphorus, quite a different result was obtained. The action began at a much lower pressure than in the former case, and at 21° not until the pressure was reduced to 202 mm. In this case, the velocity of the reaction is not proportional to the pressure itself, but seemingly to the square root of the partial pressure of the oxygen. This is only true, however, at 20°, up to a pressure of 60—70 mm.; above this pressure, the velocity decreases.

Somewhat similar results to those obtained with dry oxygen and phosphorus were obtained with sulphur and oxygen. The experiments were conducted at the temperature of boiling turpentine. The velocity of the action is proportional to the square root of the pressure rather than to the pressure itself.

Experiments with aldehyde vapour and oxygen led to the conclusion that these react with formation of acetic acid with a velocity which is proportional to the pressure of the aldehyde vapour and to the square root of the pressure of the oxygen. It is possible that a pressure of oxygen exists above which this is no longer true.

The results with aldehyde vapour show the probability of the existence of free atoms in oxygen. There can be little doubt, from analogy, that the oxygen molecule would, at a sufficiently high temperature, be dissociated into its atoms. Equilibrium will be established when the concentration of the atoms has reached a certain value determined by the equation $C_{(O_2)} = k\ C^2_{(O)}$, where $C_{(O_2)}$ is the concentration of the oxygen molecules, and $C_{(O)}$ that of the atoms. k is a constant which depends on the temperature. The equilibrium will change with falling temperature in such a way that the concentration of the oxygen atoms will diminish. It will, however, probably never become nothing. If this is true at ordinary temperatures, we shall have

$$C_{(O)} = \text{const.}\ \sqrt{C_{(O_2)}}.$$

As the concentration of the oxygen atoms is small, we can put the concentration of the oxygen molecules proportional to the pressure of the gas, and the concentration of the oxygen atoms will then be proportional to the square root of the pressure of oxygen. If we assume therefore that the atoms alone take part in the oxidation of the aldehyde, we shall have the velocity of the action always proportional to the square root of the pressure of the oxygen.

Possibly in the case of sulphur and phosphorus with dry oxygen, the reaction takes place in stages. The velocity of the whole reaction would then be the sum of the velocities of the partial reactions, each one of which would be proportional to the concentration of the oxygen atoms. H. C.

Apparatus for Fractional Distillation under Very Low Pressures. By GEORG W. A. KAHLBAUM (*Ber.*, 1895, **28**, 392—395). —This apparatus is designed for distillations under a pressure of, say, 3 mm., the mercury pump being used; it is illustrated by means of a sketch. All the joints are made air-tight with mercury seals, and the receiver has a slightly novel construction, the drops falling into little cups attached to a central vertical tube (which can be turned on its axis) down which they flow and by which they are directed into flasks attached underneath. C. F. B.

Laboratory Apparatus. By C. V. SCHON (*J. pr. Chem.*, 1895, [2], **51**, 100—102).—The author describes a form of apparatus for the distillation of zinc methyl in an atmosphere of carbonic anhydride; and another arrangement by means of which a gas can be conveniently passed through a liquid containing a solid in suspension, the delivery tube being at the same time rotated so as to stir the liquid. A. H.

Improved Laboratory Apparatus. By JAKOB VOLHARD (*Annalen*, 1895, **284**, 233—244).—The disadvantages of the constant-level water bath in general use are pointed out; it is shown that these may be overcome by introducing a few structural modifications, and employing one reservoir of distilled water to supply all the water baths of a laboratory.

An apparatus for heating sealed tubes to high temperatures is described, in which the vapour of boiling petroleum is used as a substitute for air. A copper boiler, pierced longitudinally by two cylindrical tubes, opens, on its upper surface, into a metallic condenser of such construction, that until it approaches the boiler, the condensed petroleum is separated from the ascending vapour. By means of a three-way tap in the tube through which the condensed petroleum travels, the apparatus may be used either as a distillation or reflux apparatus. Commercial petroleum, which begins to boil at about 130°, is introduced into the boiler, and the more volatile portions distilled off until the boiling point of the liquid reaches the temperature at which it is required to heat the tubes. The latter are enclosed in wrought-iron cylinders, welded at one end to an iron plate, and closed at the other with a screw-cap; an iron shield at this end of the furnace renders the apparatus free from danger.

By a simple modification in the form of the tiles, the author has increased the efficiency of the ordinary combustion furnace; the consumption of gas under the new conditions is very considerably lessened. M. O. F.

A New Shaking and Stirring Apparatus. By EWALD SAUER (*Ber.*, 1895, **28**, 559—560).—This is driven by a hot-air engine, and will shake a 6-litre bottle, or a framework containing 4 to 8 bottles of 500 c.c. capacity, and, at the same time, will drive 6 to 10 Witt's stirrers, a centrifugal machine, a mill, &c. C. F. B.

An Extremely Simple Centrifugal Apparatus. By GEORG W. A. KAHLBAUM (*Ber.*, 1895, **28**, 391—392).—The apparatus consists of two test-tubes, the one sliding in the other; the inner tube has its end cut off, and closed by a piece of platinum gauze melted on to the glass. The crystalline magma is placed in the inner tube, which is then closed with a cork, and the whole apparatus is whirled round at the end of a string attached to the open end of the outer test-tube. C. F. B.

Inorganic Chemistry.

Solubility of Ozone in Water. By L'ABBÉ MAILFERT (*Compt. rend.*, 1894, **119**, 951—953).—The solubility of ozone in water can be demonstrated by the odour of the solution, its action on silver oxide and on mercury, and the formation of hydrogen peroxide in contact with ether. The solubility was determined by allowing highly ozonised oxygen to remain in contact with water for some days, and then estimating the quantity of ozone both in the solution and in the residual gas. The results are given in the following table, the coefficient of solubility being the ratio of the weight of ozone in 1 litre of water to the weight of ozone in 1 litre of the residual gas.

T°.	0°.	6°.	11·8°.	13°.	15°.	19°.	27°.
Milligrams of ozone in 1000 c.c. of water..	39·4	34·3	29·9	28·0	25·9	21·0	13·9
Coefficient of solubility	0·641	0·562	0·500	0·482	0·456	0·381	0·270

T°.	32°.	40°.	47°.	55°.	60°.
Milligrams of ozone in 1000 c.c. of water..	7·7	4·2	2·4	0·6	0·0
Coefficient of solubility	0·195	0·112	0·077	0·031	0·000

Ozone is much more soluble than oxygen. The solubility is the same in acidified water as in pure water up to 20°, but is greater at higher temperatures.

T°.	30°.	33°.	42·7°.	49°.	57°.
Coefficient of solubility in acidified water.........	0·240	0·224	0·174	0·156	0·096

It seems possible that aqueous solutions of ozone may be valuable as sterilisers or disinfectants. C. H. B.

Phosphorus Chloronitride and two of its Homologues. By Henry N. Stokes (*Ber.*, 1895, **28**, 437—439).—When phosphorus chloronitride, $P_3N_3Cl_6$, is prepared by distilling a mixture of ammonium chloride and phosphorus pentachloride, two compounds of the same empirical formula are also obtained in small quantity.

Phosphorus chloronitride, $P_4N_4Cl_8$, crystallises from benzene in prisms. It melts at 123·5° (corr.), and boils at 328·5°; it is not very volatile in an atmosphere of steam. Boiling water, acids, and alkalis are without action on it, but when the ethereal solution is agitated with water for four hours, a crystalline chlorhydrin is produced, undergoing conversion into *tetrametaphosphinimic acid*, $P_4N_4O_8H_8 + 2H_2O$, a remarkably stable acid, which yields three series of salts. The analogous *trimetaphosphinimic acid*, $P_3N_3O_6H_6$, is obtained from the previously known chloronitride, and the intermediate product is a crystalline *chlorhydrin*, $P_3N_3Cl_4O_2H_2$. The *chloramide*, $P_3N_3Cl_4(NH_2)_2$, is obtained by agitating the ethereal solution of the chloronitride with aqueous ammonia; it crystallises from water.

An oily *compound*, $(PNCl_2)_x$, is also obtained by distilling a mixture of ammonium chloride and phosphorus pentachloride. It is not volatile in an atmosphere of steam, and is indifferent towards boiling water. Agitation of the ethereal solution with water, however, gives rise to a crystalline metaphosphinimic acid, which is decomposed into tetrametaphosphinimic acid and ammonium phosphate by the action of boiling water. M. O. F.

The Arsenites. By Alfred Stavenhagen (*J. pr. Chem.*, 1895, [2], **51**, 1—42).—The author has reinvestigated the arsenites of a large number of the metals, and has succeeded in preparing a number of new salts. In some cases it was found impossible to obtain salts which had been previously described, whilst in other cases the salts, prepared according to the description of previous authors, were found to have a different composition from that which had been assigned to them.

New salts.	Salts previously described.	Author's results with salts previously described.
K_3AsO_3	$KAsO_2$ (Pasteur)	Not obtained pure.
	$K_4As_2O_5$ (Pasteur)	$K_4As_2O_5 + 6H_2O$.
	$K_2As_4O_7 + 2H_2O$ (Pasteur)	
	$K_4As_6O_{11} + 3H_2O$ (Bloxam)	Could not be obtained.
Na_3AsO_3	$NaAsO_2$ (Pasteur) $Na_2S_2O_5$ (Pasteur)	Composition could not be determined with certainty.
$(NH_4)_3AsO_3$ (?)	$(NH_4)AsO_2$ (Pasteur and Luynes) $(NH_4)_2As_2O_5$ (Stein)	Composition could not be determined with certainty.
	$Ca_3(AsO_3)_2$ (Kühn)	
	$Ca(AsO_2)_2$ (Simon)	
	$Ca_2As_2O_5 + H_2O$ (Stein, Simon, Bloxam)	
	$Ca_3As_4O_9 + 3H_2O$ (Stein)	Could not be obtained.
$Sr_3(AsO_3)_2$ (?)	$Sr(AsO_2)_2 + 4H_2O$ (Stein)	Not obtained pure.
$Sr_2As_2O_5 + 2H_2O$	—	
$Ba_3(AsO_3)_2$	$Ba(AsO_2)_2$ (Filhol)	
	$Ba_2As_2O_5 + 4H_2O$ (Stein)	$Ba_2As_2O_5 + 2H_2O$.
	$BaH_4(AsO_3)_2$ (Bloxam)	Could not be obtained.
	$Mg_3(AsO_3)_2$ (Stein)	Could only be obtained by a new method.
	$MgAs_2O_5$ (Bloxam)	
	$Mg_2As_2O_5 + H_2O$ (Bloxam)	Could not be obtained.
	$Zn_3(AsO_3)_2$ (Bloxam)	
$Cd_3(AsO_3)_2$	—	
Hg_3AsO_3	—	
$Hg_3(AsO_3)_2$ (?)	—	
Cu_3AsO_3 (?)	$CuHAsO_3$ (Bloxam)	Could not be obtained pure.
$Cu(AsO_2)_2 + 2H_2O$	—	
	Ag_3AsO_3 (Pasteur)	
	$Ag_4As_2O_5$ (Pasteur)	Could not be obtained pure.
	$Ag_6As_4O_9$ (Girard)	Could not be obtained.
$AuAsO_3 + 2H_2O$	—	
Tl_3AsO_3	—	
$Sn_3(AsO_3)_2 + H_2O$	—	
$Sn_3(AsO_3)_4 + 5\frac{1}{2}H_2O$	—	
	$Pb_3(AsO_3)_2 + H_2O$ (Kühn-Streng)	
	$Pb(AsO_2)_2$ (Berzelius)	
	$Pb_2As_2O_5$ (Berzelius, Filhol)	
$BiAsO_8 + 5H_2O$ (?)	—	
	$CrAsO_3$ (Neville)	Could not be obtained.
$Mn_3(AsO_3)_2 + 3H_2O$	$Mn_3H_2As_4O_{10} + 4H_2O$ (Stein)	Not obtained pure.
$Co_3(AsO_3)_2 + 4H_2O$	$Co_2As_2O_5$ (Girard)	
	$Co_3As_4O_9 + 4H_2O$ (Girard)	Could not be obtained.
	$Ni_2As_2O_5$ (Girard)	Not obtained pure.
	$Ni_3As_4O_9 + 4H_2O$ (Girard)	
$Pt_3(AsO_3)_4$	—	

The arsenites may be considered as derived from ortho-arsenious acid, H_3AsO_3; meta-arsenious acid, $HAsO_2$; or pyro-arsenious acid, $H_4As_2O_5$.

The table on p. 218 summarises the results obtained. The methods of preparation and properties are given in detail in the original.

The substances marked (?) were not obtained perfectly pure. The most important memoirs to which reference is made are the following: Simon, *Ann. Phys. Chem.*, 1837, **40**, 442; Pasteur, *Annalen*, 1848, **68**, 309; Stein, *Annalen*, 1850, **74**, 218; Girard, *Compt. rend.*, 1852, **34**, 918; *Annalen*, 1852, **84**, 254; 1853, **88**, 249; Kühn, *Arch. Pharm.*, [2], **69**, 267.

The author was unable to prepare a definite compound of arsenious oxide with ferric hydroxide. It is possible that the action of ferric hydroxide as an antidote in cases of poisoning by arsenious oxide is due to the fact that it prevents the reduction of the oxide to arsine, to the formation of which the author is inclined to ascribe the fatal effects. A. H.

Graphite. By HENRI MOISSAN (*Compt. rend.*, 1894, **119**, 976—980).—The author has investigated the rate of oxidation, the ignition points, and the sp. gr. of the different varieties of graphite obtained by (1) heating diamond in an arc produced by a current of 350 ampères and 70 volts, (2) condensation of sublimed carbon on the positive electrode, (3) the alteration of the extremities of the electrodes, (4) condensation of sublimed carbon on a cooled tube, (5) the action of an arc (as above) on carbon from sugar, (6) the action of a current of 2200 ampères and 60 volts on wood-charcoal contained in a crucible in the electric furnace. Similar determinations were made with the graphite obtained by saturating aluminium, maganese, nickel, chromium, tungsten molybdenum, uranium, zirconium, and vanadium with carbon in the electrical furnace, the metal being removed by treatment with chlorine, and the amorphous carbon by the action of fuming nitric acid on the residue.

The graphite thus obtained may be amorphous or crystalline. Its sp. gr. varies between 2·10 and 2·25, and its temperature of ignition in oxygen is about 660°. There are several varieties of graphite, just as there are several varieties of amorphous carbon, and their stability, and in particular their resistance to the action of a mixture of potassium chlorate and nitric acid, increases with the temperature to which the graphite was subjected.

When graphite is treated with fuming nitric acid and potassium chlorate in the manner described by Berthelot, the oxidation is somewhat slow, and the colour of the graphitic oxide varies from green or deep maroon to yellow. If, however, the nitric acid is prepared by the action of a large excess of boiled sulphuric acid on recently fused potassium nitrate, and the potassium chlorate is carefully dried, oxidation of the graphite is more rapid, and the graphitic oxide is yellow or almost colourless. The quantity of potassium chlorate necessary is from 20 to 30 times the weight of the graphite, and the oxidation must be completed at 60°, although care must be taken that the temperature does not rise to this point in the early stages of the reaction. C. H. B.

Displacement of Carbon from Fused Cast Iron by Boron and Silicon. By HENRI MOISSAN (*Compt. rend.*, 1894, **119**, 1172—1175).—When grey cast iron containing about 3·2 per cent. of carbon is strongly heated in a porcelain boat brasqued with boron and contained in a porcelain tube through which a current of hydrogen is passed, the boron displaces the carbon, which is reduced to 0·36—0·14 per cent., whilst at the same time the quantity of slag present in the iron is considerably reduced because the boron combines readily with the impurities. The residual iron contains 8 to 9 per cent. of boron. Similar effects are observed with white cast iron, the carbon in one case being reduced from 3·85 to 0·24 per cent., and the slag from 0·36 to 0·06 per cent. When cast iron containing 10 per cent. of boron is added to 10 times its weight of grey cast iron fused in a forge, there is still a notable displacement of carbon, and the metal has a lamellar structure, is very hard, and resembles white cast iron in appearance.

Crystallised silicon, under similar conditions, displaces carbon from grey or white cast iron, the carbon separating in the form of graphite. The same effect is observed with fused silicon and a highly carburetted iron prepared in the electric furnace from soft iron and sugar-charcoal, the carbon separating as brilliant crystals of graphite.

The fact that the displacement of carbon by silicon is not quite complete is probably due to the establishment of a state of equilibrium between the iron silicide and the iron carbide, the conditions of equilibrium varying with the temperature and with the impurities which are always present in white or grey cast iron. C. H. B.

Graphites from Iron. By HENRI MOISSAN (*Compt. rend.*, 1894, **119**, 1245—1250).—The author has investigated the graphites formed in cast iron under various conditions of temperature and pressure.

Graphite from grey cast iron which melts at about 1150° can be separated from the metal and the amorphous carbon by successive treatments with chlorine at a dull red heat, fuming nitric acid, and hydrofluoric acid; its sp. gr. is 2·17, and it ignites in oxygen at 670°. If the metal is treated with hydrochloric acid mixed with a little nitric acid, instead of being heated in chlorine, and the residue is washed and dried, and then subjected to several treatments with fuming nitric acid, followed by hydrofluoric acid, and, finally, concentrated sulphuric acid, the graphite obtained contains only 80 to 85 per cent. of carbon, 1·30 per cent. of ash, and 0·15 to 0·80 per cent. of hydrogen. It would seem therefore that in the action of the acids on the metal a complex compound of carbon, hydrogen, oxygen, and perhaps also nitrogen, is formed, and is not decomposed even when the graphite is heated at 400°. The possible formation of such compounds, which is probably the result of the hydrogenisation, followed by oxidation, of the iron carbide, should be taken into account in all investigations of the graphites obtained from metals (compare preceding abstract).

When soft iron, mixed with an excess of carbon from sugar, is heated in a carbon crucible in the electric furnace with a current of 2000 ampères and 60 volts for 10 minutes, the iron dissolves large quantities of carbon, and becomes so pasty that the crucible can be inverted without the contents running out. The graphite obtained from this iron ignites in oxygen at about 650°; it contains only 0·28 per cent. of hydrogen, and is therefore much purer than graphite from ordinary cast iron; sp. gr. = 2·18. It is oxidised with considerable difficulty.

In order to ascertain the effect of pressure, the fused iron containing carbon was suddenly cooled by immersion in water (Abstr., 1893, ii, 275). The graphite then obtained is in the form of short crystals with blunted angles, and of irregular masses which have the appearance of incipient fusion; sp. gr. = 2·16; temperature of ignition in oxygen 660°. It contains 0·64 per cent. of hydrogen and 1·29 per cent. of ash.

The graphite displaced from cast iron by silicon (preceding abstract) forms very regular black crystals of sp. gr. 2·20; it contains 0·2 per cent. of hydrogen, 0·85 per cent. of ash, and 98·82 per cent. of carbon. This form of graphite is readily oxidised.

Graphite separated from cast iron saturated with carbon in the electric furnace was allowed to cool out of contact with air, and was then heated in a vacuum at 500°, and afterwards burnt in oxygen. No water was formed, and it follows that hydrogen does not pre-exist in graphite, but is a result of the hydrogenisation of the iron carbide, or perhaps of the amorphous carbon, under the influence of reagents.

The general conclusion is that at the ordinary pressure the graphite is purer; it is also less easily attacked by a mixture of nitric acid and potassium chlorate the higher the temperature at which it is obtained. The small quantity of hydrogen present in graphite diminishes as the purity increases. C. H. B.

Intumescent Graphite. By HENRI MOISSAN (*Compt. rend.*, 1895, **120**, 17—19).—The author has previously described (Abstr., 1893, ii, 320) a method of preparing intumescent graphite by dissolving carbon in melted platinum. His later experiments prove that graphite obtained simply by the action of a high temperature on any form of carbon, or by the condensation of carbon vapour, shows no trace of intumescence when treated with strong nitric acid; on the other hand, all the graphites obtained by dissolving carbon in some metal at a high temperature are intumescent. It would seem that the temperature is at least as important as the action of the metal; the graphite from grey cast iron showed no intumescence, but after the metal had been heated in the electric furnace with a current of 2000 ampères and 50 volts the graphite was highly intumescent.

For all varieties of intumescent graphite produced at a high temperature, the temperature of intumescence lies between 165 and 175°. If a small quantity of the graphite is treated with nitric acid, dried at a gentle heat, and then more strongly heated in a vacuous tube, it gives off a mixture of carbonic anhydride, nitrogen, and nitrogen oxides, whilst a small quantity of nitric acid condenses on the sides of the tube. This result confirms the author's view (*loc. cit.*) that the intumescence is due to the sudden liberation of heated gases.

Natural intumescent graphites seem to have been produced at a somewhat high temperature, but not under very great pressure, in the midst of masses of iron which have since disappeared.

C. H. B.

Carbon Monosulphide. By ALBERT DÉNINGER (*J. pr. Chem.*, 1895, [2], **51**, 346—349).—Carbon monosulphide appears to be formed when sodium sulphide is heated with chloroform at 180°, and when silver iodide is heated with iodoform. It is best obtained, mixed with hydrogen, by bringing 15 grams of sodium into 125 c.c. of dry aniline, and adding 150 c.c. of carbon bisulphide. A gas is given off which is passed through aqueous soda, over india-rubber, and, finally, through triethylphosphine. It readily burns with a blue flame forming sulphurous anhydride. The gas is very readily absorbed by alcohol and aniline, has a pleasant smell of (pure) carbon bisulphide, and condenses in a freezing mixture to a very volatile liquid, the constants of which have not been determined. When mixed with oxygen and ignited, it explodes violently. A. H.

Preparation of Amorphous Silicon. By VIGOUROUX (*Compt. rend.*, 1895, **120**, 94—96).—Amorphous silicon is readily obtained by the action of magnesium on silica, provided that the materials are quite dry, and that the action is moderated by the presence of magnesium oxide. In absence of the oxide, the temperature of the reaction is too high, and some of the silicon is fused. Silica is not so satisfactory as magnesia for this purpose.

Powdered quartz and magnesium powder such as is used for photographic purposes are mixed in the calculated proportions, and to the mixture is added one-fourth of its weight of calcined magnesia. The three substances are very intimately mixed and placed in a fire-clay crucible, which they must not more than half fill. A layer of magnesia is placed on the top, and the crucible is then heated at 300—400°, in order to thoroughly dry the contents. The crucible with its cover is then heated to redness for a few minutes, and as soon as the action ceases it is allowed to cool. Reduction takes place at 540°. If the mixture is placed on a plate and covered with magnesium powder, and the latter is ignited, reduction spreads throughout the mass.

The product is heated with hydrochloric acid, then with boiling sulphuric acid, then two or three times alternately with hydrofluoric acid and sulphuric acid, and, finally, with hydrochloric acid. After drying, the silicon forms a maroon coloured, homogeneous powder containing only 1·0 to 0·4 per cent. of impurities. Any small globules of fused silicon can, if necessary, be removed by levigation.

C. H. B.

Constitution of Silver-Ammonia Compounds. By ALBERT REYCHLER (*Ber.*, 1895, **28**, 555—558).—The electrical conductivity of, and depression of freezing point caused by, the compounds of ammonia with silver nitrate, nitrite, acetate, and sulphate, and with copper nitrate and nitrate have been examined. It is found that ammonia in the proportion of $2NH_3$ per equivalent of silver or copper is taken up without the molecular depression or equivalent conductivity being altered; ammonia present in excess of this quantity does affect these values, and hence is split off in solution. The firm fixation of a second NH_3-group is not in accord with the old theory of silver-ammonia compounds. The author prefers to explain the facts in terms of his own theory of the nature of solutions (Abstr., 1893, ii, 315).

C. F. B.

Silver Sulphide. By ALFRED DITTE (*Compt. rend.*, 1895, **120**, 91—93).—When silver sulphide is allowed to remain in contact with a cold saturated solution of potassium monosulphide out of contact with light, it is gradually converted into red crystals of the double sulphide $4Ag_2S,K_2S + 2H_2O$, which forms brilliant plates composed of microscopic needles. In very thin films, it transmits garnet-red light. The same compound can be formed in hot solutions, but the solution of alkali sulphide must be highly concentrated and the product is liable to be impure.

The silver potassium sulphide changes when exposed to light, and becomes dark grey; it is decomposed by water, especially on heating, with separation of black silver sulphide. In presence of cold water a condition of equilibrium is established between the water, the double sulphide and the simple sulphides resulting from its decomposition. A solution of 300 grams of potassium monosulphide per litre has no action on the double sulphide at 5°. It is clear that if an aqueous solution can be prepared which acts neither on silver sulphide nor on the double sulphide, except to dissolve small quantities of the latter, and if this liquid undergoes small changes of temperature sufficient to decompose the dissolved double sulphide, the conditions will be favourable to the formation of crystallised silver sulphide. As a matter of fact, a solution of 350 grams of potassium monosulphide per litre at 20° converts amorphous silver sulphide after some days into grey-black lustrous crystals.

A cold saturated solution of sodium sulphide does not contain sufficient of the salt to admit of the formation of a double sulphide, but a hot solution containing 800 grams of the anhydrous sulphide per litre converts silver sulphide into red crystals of the double sulphide, $3Ag_2S,Na_2S + 2H_2O$. It is decomposed by cold water and also by a cold saturated solution of sodium sulphide.

A hot highly concentrated solution of sodium sulphide converts silver sulphide into a vermilion coloured, crystalline powder which, however, it is difficult to obtain pure.

C. H. B.

Solubility of Strontium Bromide in Alcohol. By FONZES-DIACON (*J. Pharm.*, 1895, [6], **1**, 59).—The solubility of anhydrous strontium bromide in alcohol is practically constant between 0° and 40°, 100 c.c. of absolute alcohol dissolving about 64·5 grams of the anhydrous salt and forming a solution having a sp. gr. = 1·210 at 0°. When left in closed flasks, this solution deposits large, orthorhombic prisms of the composition $2SrBr_2,5EtOH$.

L. T. T.

Valency of Beryllium. By ALPHONSE COMBES (*Compt. rend.*, 1894, **119**, 1221—1223).—Beryllium is now generally regarded as bivalent, the formula of its oxide being BeO, but Hautefeuille's observation that beryllia can partially replace alumina in certain silicates and Wyrouboff's observation that beryllium silicotungstates are isomorphous with aluminium silicotungstates but not with the magnesium compounds, make further proof of the bivalent character of beryllium desirable.

Beryllium acetylacetonate is readily obtained as a white crystalline precipitate by mixing solutions of equivalent quantities of beryllium acetate and acetylacetone; it is very slightly soluble in cold water but more soluble in hot water, and very soluble in alcohol from which it crystallises in large crystals belonging to the rhombic system, whereas the aluminium compound crystallises in the monoclinic system. Beryllium acetylacetonate melts at 108°, sublimes partially at 100°, and boils at 270° under ordinary pressure without decomposing. Two determinations of the vapour density, the first at the boiling point of diphenylamine, and the second at the boiling point of mercury, gave the values 7·26 and 7·12 respectively. The value calculated for $Be(C_5H_7O_2)_2$, where Be = 9, is 7·16, whilst the value for $Be(C_5H_7O_2)_3$, where Be = 13·5, is 10·75.

It follows that beryllium is bivalent, and the formula of its oxide is BeO. (Compare Abstr., 1889, 571.) C. H. B.

Zinc and Manganese Sulphides and the Protomorphic State. By A. VILLIERS (*Compt. rend.*, 1895, **120**, 97—99).—The author applies the term *protomorphic state* to the condition in which nickel, cobalt and zinc sulphides and other compounds exist at the moment of their formation.

In the case of zinc sulphide the change is very rapid in hot solutions, but comparatively slow at the ordinary temperature. Thomsen found (Abstr., 1879, 206) that a solution of sodium sulphide gives an immediate precipitate with zinc sulphate; with sodium hydrosulphide, on the other hand, the precipitate is formed if the two substances are mixed in equivalent proportion, but only an opalescent liquid is obtained if double the proportion of hydrosulphide is added.

The author finds that if zinc sulphate is added to sodium hydroxide solution until the precipitate just ceases to redissolve, and hydrogen sulphide is passed into the liquid, there is at first a precipitate, but this completely redissolves if the passage of the gas is continued, provided that the solution contains not more than 1 per cent. of zinc sulphate. If the liquid is boiled or is mixed with alkalis or dilute acids, zinc sulphide is precipitated.

If, in the experiment just described, the passage of hydrogen sulphide ceases when a precipitate is formed, and the vessel is then closed, allowed to remain for some hours at the ordinary temperature, and again treated with a current of the gas, the precipitate will not redissolve, and hence has undergone some change. The soluble modification of zinc sulphide is always amorphous, the insoluble is always crystalline. The behaviour of zinc sulphide when precipitated from alkaline solutions by hydrogen sulphide, may cause errors in analysis, and it is always better to precipitate in presence of acetic acid.

No evidence of a change of state could be obtained in the case of manganese sulphide. C. H. B.

Constitution of Inorganic Compounds. By Alfred Werner (*Zeit. anorg. Chem.*, 1895, **8**, 153—188 and 189—197).—Two theoretical papers dealing with the constitution of the ammonio-metallic compounds. (Compare Jörgensen, *ibid.*, **5**, 147, and **7**, 289; and Werner, *ibid.*, **3**, 267.) E. C. R.

Double Decomposition between Gaseous Compounds. By Henryk Arctowski (*Zeit. anorg. Chem.*, 1895, **8**, 213—223).—When two compounds, capable of acting on one another so that one of the products is removed from the sphere of action as it is formed, are mixed in the form of vapour, a double decomposition takes place in a similar way to the double decomposition so well-known in aqueous solution.

The author has examined the action of hydrogen sulphide on several volatile salts; the method of procedure being as follows:—the salt is placed in a hard glass tube, and dry hydrogen passed over it. In the front part of the tube some sulphur is placed, and when the air is completely expelled, the sulphur is heated so that hydrogen sulphide is produced; at the same time the salt is volatilised. The tube is heated at 400—450°. With mercuric chloride, a reaction at once takes place and the black modification of mercury sulphide described by Spring (this vol., ii, 110) is formed. The product is crystalline, and shows the characteristic habit of natural metacinnabarite. When sulphur vapour is mixed with mercuric chloride vapour by means of a current of carbonic anhydride, no action takes place, showing that the mercury sulphide is the product of the double decomposition of hydrogen sulphide and mercuric chloride. Ferric chloride when treated in the same way yields a greyish-black, crystalline powder which under the microscope is seen to contain lustrous, yellow crystals.

The following sulphides have been prepared in the same manner. Antimony sulphide, Sb_2S_3, in crystals identical with the natural compound; when the action takes place at a higher temperature, beautiful long lustrous plates are formed. Arsenic trichloride is decomposed in a similar manner, and arsenic burns with a dark blue flame. Tin sulphide is obtained from the chloride in small, golden aggregates. Molybdenum pentachloride yields an extremely fine powdery sulphide and the tube becomes covered with a mirror.

E. C. R.

The Molecular Weight of Mercurous Chloride. By Michele Fileti (*J. pr. Chem.*, 1895, [2], **51**, 197—204).—The author criticises the experiments of Harris and V. Meyer (Abstr., 1894, ii, 353) and the conclusions drawn from them. He maintains, in answer to V. Meyer's latest remarks on the subject (this vol., ii, 46), that a complete dissociation of mercurous chloride does not occur, in which case the formula for this compound cannot be Hg_2Cl_2, for its vapour density is 8·14, and not between this number and 16·28. No experiment which Meyer has quoted shows that mercuric chloride vapour does not prevent, or at any rate hinder, the dissociation of mercurous chloride; all analogy is in favour of such prevention, and the author claims that his original determinations show that the molecular formula in question is HgCl. (Compare further V. Meyer, this vol., ii, 166.) A. G. B.

Reduction of Aluminium by Carbon. By HENRI MOISSAN (*Compt. rend.*, 1894, **119**, 935—937).—Many reactions that are limited at ordinary high temperatures become complete in the electric furnace in consequence of the much higher temperature obtainable. Barium carbonate, for instance, is completely decomposed. Aluminium oxide has hitherto been regarded as irreducible by carbon, but if corundum is placed in a carbon dish and heated in the carbon tube of the electric furnace with a current of 1200 ampères and 80 volts, it is completely volatilised in a few minutes, and the condensed crystals of alumina and graphite are mixed with small spheres of aluminium. If alumina is heated in a carbon tube, closed at one end, with a current of 300 ampères and 65 volts, the volatilised alumina contains some reduced aluminium. Fused alumina remains in the lower part of the tube, and against the walls of the latter, where the temperature was highest, there are small white or yellowish globules of a mixture of aluminium and aluminium carbide. More marked results of the same kind are obtained by heating a mixture of alumina and starch under the same conditions. The cooled residue in the tube is always covered with a layer of graphite formed by the condensation of volatilised carbon.

At a somewhat lower temperature, alumina can remain fused in contact with carbon without any reduction taking place. Reduction is in fact due to the interaction of alumina vapour and carbon vapour at a high temperature. If the temperature is not sufficiently high, the two vapours may mix without reacting. C. H. B.

Hydrated Metallic Chlorides. By PAUL SABATIER (*Bull. Soc. Chim.*, 1894, [3], **11**, 546—549; compare Abstr., 1889, 1049, and Lescœur, Abstr., 1893, ii, 364, and 1894, ii, 343).—A question of priority with Lescœur, and a criticism of some of his work.

Tetrahydrated manganous chloride effloresces in a dry atmosphere under low pressure to a hydrate containing $\frac{5}{3}H_2O$, and not $2H_2O$; the same salt is obtained by saturating the solution of the tetrahydrate with hydrogen chloride. The two hydrates resemble those of ferric chloride, $Fe_2Cl_6,12H_2O$ and $5H_2O$, in containing respectively $2H_2O$ and $\frac{5}{6}H_2O$ per atom of chlorine.

Hexahydrated magnesium chloride yields the pentahydrate under the above conditions as previously observed by Miller and predicted by Thomsen from thermochemical considerations.

Ferrous chloride is normally tetrahydrated, as observed by Berzelius and others, and not hexahydrated; under the above treatment, it is converted into the white or pale green dihydrate observed by Jonas, but if the solution is not completely saturated with the hydrogen chloride, the tetrahydrate is sometimes precipitated unchanged.

Copper chloride crystallises from aqueous solutions as a dihydrate; Lescœur's dark yellow monohydrate cannot be stable, as the dihydrate readily loses all its water in a dry atmosphere under low pressure.

JN. W.

Iron Chromates. By CHARLES LEPIERRE (*Compt. rend.*, 1894, **119**, 1215—1218).—No ferrous chromates seem to exist. When saturated solutions of ferrous sulphate with chromic acid or alkali chromates or dichromates are mixed at low temperatures, the chromate is reduced and basic ferric sulphates are formed. If the ferrous salt is in excess, the product is a ferrosoferric sulphate.

The action of ferrous sulphate (6 mols.) on potassium chromate (2 mols.) at 0° yields the compound $2CrO_3,6Fe_2O_3,3K_2O$, which is washed with water, alcohol, and ether at 0°; when moist, it is brown, and when dried, black. After drying in the air, it retains about 30 per cent. of water. The action of ferrous sulphate on potassium chromate at higher temperatures yields only basic ferric sulphates.

The action of excess of potassium chromate on ferrous sulphate yields a yellowish-brown, micro-crystalline precipitate of the composition $4CrO_3,3Fe_2O_3,4K_2O$, which retains 22·7 per cent. of water when dried in the air. Similar results are obtained with ammonium ferrous sulphate, the precipitate being $10CrO_3,6Fe_2O_3,7K_2O$. With sodium chromate, the precipitate is $5CrO_3,7Fe_2O_3,4Na_2O$, and with ammonium chromate, $6CrO_3,5Fe_2,O_3,6(NH_4)_2O$. With ammonium and sodium dichromates, there is immediate oxidation without formation of chromates.

The addition of a saturated solution of potassium chromate to an excess of a saturated solution of ferric chloride yields ruby-red, hexagonal crystals of the composition $11CrO_3,3Fe_2O_3,4K_2O + 9H_2O$; with excess of chromate, the precipitate is orange-yellow, and has the composition $9CrO_3,2Fe_2O_3,6K_2O + 6H_2O$, if washed with alcohol, or $10H_2O$ if washed with water; with only a slight excess of the ferric salt, the product is $10CrO_3,3Fe_2O_3,6K_2O + 5H_2O$. In hot solutions, the products, with all proportions, are complex mixtures.

Ferric chloride and potassium dichromate yield ruby-red crystals of the compound $7CrO_3,2Fe_2O_3,2K_2O + 7H_2O$; with a large excess of dichromate, the compound obtained by Hensgel in another way, $4CrO_3,Fe_2O_3,K_2O + 4H_2O$, is also formed; with excess of ferric chloride, potassium chlorochromate is one of the products. By diffusion of one solution into the other, an anhydrous crystallised chromate, $6CrO_3,2Fe_2O_3,3K_2O$, is obtained.

In hot solutions with large excess of dichromate, the so-called "jaune siderin" is obtained; it has the composition

$$16CrO_3,4Fe_2O_3,5K_2O + 8H_2O.$$

Ferric chloride and ammonium dichromate in the cold yield Hensgel's chromate, $4CrO_3,Fe_2O_3,(NH_4)_2O + 4H_2O$, in red crystals.

C. H. B.

Metallic Sulphides. By A. VILLIERS (*Compt. rend.*, 1894, **119**, 1208—1210).—It is well known that cobalt and nickel sulphides in their ordinary form are insoluble in moderately concentrated hydrochloric acid, although the sulphides are not precipitated by hydrogen sulphide from slightly acidified aqueous solutions of nickel and cobalt salts of inorganic acids, whereas zinc sulphide is partially precipitated from acid solutions of zinc salts, although zinc sulphide is dissolved by dilute acids. The author considers that at the moment of their formation the cobalt and nickel sulphides are in a form more readily soluble in dilute acids than zinc sulphide, but in the absence of free acid they at once, and spontaneously, undergo a change analogous to that which takes place when chromic oxide and aluminium oxide are heated at a high temperature, and become in consequence insoluble in acids.

The author considers that this hypothesis explains the results obtained by Baubigny (Abstr., 1882, 805, 928, 1031, 1032, 1172), but is unable to accept Baubigny's view that the observed phenomena are due to the formation and subsequent decomposition of hydrosulphides of the sulphides.

It is probable that in neutral or feeble acid solutions of nickel and cobalt salts hydrogen sulphide produces, as in the case of zinc salts, an immediate, but very minute, precipitate, and this at once undergoes either a simple molecular condensation or a condensation accompanied by loss of water or hydrogen sulphide, and becomes insoluble in acids. Equilibrium is thus disturbed, and the separation of the sulphide continues slowly until a limit is reached which is independent of the degree of dilution of the free acid originally present. Even if zinc sulphide undergoes a similar change, it remains soluble in acids. (See also Baubigny, Abstr., 1888, 113.) C. H. B.

Nickel and Cobalt Sulphides. By A. VILLIERS (*Compt. rend.*, 1894, **119**, 1263—1266).—Nickel sulphide only dissolves in ammonium or sodium sulphides or hydrosulphides in presence of air or an excess of sulphur. If, however, a nickel solution is mixed with excess of sodium hydroxide (not potassium hydroxide) to which has been added sufficient tartaric acid to prevent precipitation of nickel hydroxide, and the liquid is saturated with hydrogen sulphide, a black liquid is obtained without the formation of any precipitate. The tartaric acid simply prevents precipitation of nickel hydroxide, and if freshly precipitated hydroxide is immediately treated with hydrogen sulphide in presence of excess of sodium hydroxide, part of the nickel sulphide dissolves in the alkali sulphide. With an ammoniacal solution of nickel oxide, no similar phenomenon is observed, and the nickel sulphide dissolves only in presence of air. It is clear that nickel sulphide at the moment of its formation has properties different from those of the ordinary precipitated sulphide, and the difference is due to a molecular change which takes place very rapidly (preceding abstract).

If two equal volumes of a nickel solution are mixed with equal volumes (in excess) of sodium hydroxide, and saturated with hydrogen sulphide, in the one case rapidly and in the other slowly, the greater part of the nickel sulphide remains in solution in the former case, but is precipitated in the latter. If hydrogen sulphide is passed into a boiling solution of a nickel salt, mixed with tartaric acid and excess of sodium hydroxide, only very little of the nickel sulphide remains in solution, the molecular change being much more rapid at the higher temperature. On the other hand, the black solution formed in the cold can be boiled for a long time without precipitation of the sulphide, but precipitation takes place immediately on the addition of a slight excess of acid.

Cobalt sulphide is insoluble in excess of alkali sulphides or hydrosulphides, except in presence of a very large excess of sulphur, when traces of cobalt will dissolve. It follows that cobalt sulphide is either insoluble in alkali sulphides at the instant of its formation, or undergoes molecular change with much greater rapidity than nickel sulphide. The latter view seems to be correct, for with cobalt solutions containing not more than 3 or 4 parts of the salt in 100,000, the same phenomena are observed as with nickel, provided that too large an excess of sodium hydroxide is not added. C. H. B.

Green Chromic Chloride, $CrCl_3,6H_2O$. By AUGUSTO PICCINI (*L'Orosi*, **17**, 329—334).—Silver nitrate at once precipitates two-thirds of the chlorine present in aqueous solutions of green chromium chloride; the remaining third is only precipitated very slowly. The author shows that silver fluoride immediately precipitates the whole of the chlorine present. Silver nitrate immediately precipitates the whole of the chlorine from solutions of green chromic chloride; in ethylic alcohol or acetone, as is shown by boiling point determinations, no electrolytic dissociation occurs. Methylic alcohol solutions of the green salt are intermediate in behaviour between aqueous and ethylic alcohol solutions, both in respect to the amount of chlorine which is immediately precipitable by silver nitrate, and the extent to which electrolytic dissociation occurs. In those cases in which all the chlorine is precipitated immediately by silver nitrate, the supernatant chromium solution remains green, whilst in those in which only a part separates at once as silver chloride, the solution gradually becomes violet. W. J. P.

Complex Inorganic Acids. By WOLCOTT GIBBS (*Amer. Chem. J.*, 1895, **17**, 73—91; compare this Journal, 1877, ii, 847, and Abstr., 1886, 511).—*Platinotungstates.*—The best method for preparing these salts is by dissolving pure crystallised sodium tungstate in water, adding a large excess of soda, and then, gradually, a neutral solution of platinic chloride until a distinct excess of platinic hydroxide is present. Acetic acid is then added in slight excess. The following salts were obtained.

$10WO_3,PtO_2,4Na_2O + 23$ aq.	Yellow crystals.
$10WO_3,PtO_2,6Na_2O + 28$ aq.	Dull orange crystals.
$20WO_3,PtO_2,9Na_2O + 58$ aq.	Topaz-yellow crystals.
$30WO_3,2PtO_2,15Na_2O + 89$ aq.	Dull yellowish crystals.
$30WO_3,PtO_2,12Na_2O + 72$ aq.	Large, honey-yellow crystals.

Qualitative tests point to iridium, ruthenium, palladium, and osmium forming similar salts.

Platinomolybdates.—The following are described.

$8MoO_3,2PtO_2,3Am_2O + 12 aq.$	Lemon-yellow crystals.
$4MoO_3,2PtO_2,2Am_2O + 19 aq.$	Dark brown mass.
$60MoO_3,PtO_2,10K_2O + 40 aq.$	Granular, yellow crystals.

In almost all these salts, the alkali may be replaced by other metals by double decomposition.

Pyrophosphomolybdates and *Pyrophosphotungstates.*—The following are described.

$22MoO_3,2P_2O_5,7MnO,9Na_2O + 57 aq.$	Bright yellow crystals.
$20MoO_3,2P_2O_5,10MnO,5Am_2O + 10 aq.$	Buff compound.
$14WO_3,P_2O_5,3MnO,6Na_2O + 36 aq.$ ..	Brownish-orange crystals.
$28WO_3,2P_2O_5,6MnO,5Am_2O,2Na_2O + 48 aq.$	Orange prisms.

These salts are mostly soluble in boiling water. L. T. T.

Atomic Weight of Tungsten. By MARY E. PENNINGTON and EDGAR F. SMITH (*Zeit. anorg. Chem.*, 1895, **8**, 198—204).—The authors are of opinion that the tungsten employed in former determinations of the atomic weight has not been free from molybdenum. They prepare their pure tungsten as follows:—Tungstic acid is heated for three days with concentrated nitric acid, and the yellow oxide washed with water and boiled several times with aqua regia and then with water until all the iron is extracted. The oxide is then dissolved in yellow ammonium sulphide, filtered, and the solution evaporated nearly to the point of crystallisation, and mixed with hydrochloric acid. The precipitate is ignited, extracted with nitric acid, and then with aqua regia, and dissolved in ammonia. The ammoniacal solution is treated with hydrogen sulphide, warmed for some hours at 80°, and then precipitated with pure, dilute hydrochloric acid. The trisulphide so obtained is heated in a porcelain crucible and converted into oxide. The product contains neither silica, iron, manganese, tin, nor tantalum, but it contains molybdenum. To eliminate the last impurity, it is heated at 150—200° in a current of hydrogen chloride, whereby the molybdenum is sublimed as the compound $MoO_3,2HCl$. The tungstic oxide is then dissolved in ammonia, crystallised three times, dried and ignited, and finally reduced by heating in a current of hydrogen. The product is greyish-black, and has the sp. gr. $= 18{\cdot}64$ at 0°.

The atomic weight was determined by estimating the amount of oxygen absorbed in the conversion of the tungsten into tungstic oxide, namely, by heating the tungsten in a porcelain crucible exposed to the air until a constant weight was obtained.

The mean results obtained from a series of nine experiments was $W = 184{\cdot}921$, taking $O = 16$. E. C. R.

Atomic Weight of Tungsten. By EDGAR F. SMITH and EN. D. DESI (*Zeit. anorg. Chem.*, 1895, **8**, 205—206).—The pure tungstic oxide was prepared as described in the preceding abstract, and the determination of the atomic weight was effected by estimating the quantity of water formed during the reduction of tungstic oxide to tungsten. The hydrogen employed in the experiments was prepared from pure zinc and sulphuric acid, and purified by passing through flasks containing potassium permanganate, alkaline lead nitrate, silver nitrate, potassium hydroxide, and sulphuric acid; it was then passed through calcium chloride, and finally through a heated tube, 23 cm. long, filled with clean iron wire. The water formed during the reduction was collected in a tube filled with calcium chloride.

The mean result obtained from a series of six experiments was W = 184·704. E. C. R.

Pyroantimonious acid. By C. SERONO (*Gazzetta*, 1894, **24**, 274—276, and *J. pr. Chem.*, 1895, [2], **51**, 97—99).—The substance described by Schaffner (*Annalen*, 1844, **51**, 182) as pyroantimonious acid, $H_4Sb_2O_5$, is stated by him to be formed when antimony trisulphide is heated with aqueous potash, and copper sulphate then added. The author finds that the substance obtained by this method is orthoantimonic acid, H_3SbO_4, which is formed at the expense of a portion of the oxygen of the cupric salt, a cuprous salt being found among the products of the reaction. A. H.

Physiological Chemistry.

Blood Gases of Brain and Muscle in Rest and Activity. By LEONARD HILL and D. N. NABARRO (*Proc. Physiol. Soc.*, 1895, 20—23).—The metabolism of resting muscles, as measured by the gaseous exchange, is very much greater than that of the resting brain. The venous blood leaving the two situations is different in colour, but this rough test is supported, in the present case, by careful and numerous analyses of the blood gases. The metabolism in muscles in the state of activity is enormously increased. The metabolism in the brain during an epileptic fit induced by absinthe is somewhat, but not constantly, increased. This last point requires still further investigation. W. D. H.

Gaseous Exchanges in Isolated Muscle. By J. TISSOT (*Compt. rend.*, 1895, **120**, 568—570).—It was Hermann who first pointed out that the absorption of oxygen and production of carbonic anhydride in muscle are two distinct phenomena. The two experiments here recorded, in which isolated frog's muscles were employed, are stated to support this doctrine. The amount of oxygen absorbed and carbonic anhydride eliminated, were, however, estimated in different muscles at various temperatures. The amount of carbonic anhydride formed rises with the temperature, even after such heat has been applied as to kill the muscle. It is therefore not a measure of physiological activity. The amount of oxygen absorbed, on the other hand, reaches a maximum at from 33°—37°, a temperature at which the muscle is most active, and then falls. W. D. H.

Regulation of Heat Production. By MARCUS S. PEMBREY (*Proc. Physiol. Soc.*, 1895, 3—4).—Experiments made on mice show that they respond to changes of external temperature like cold-blooded animals if they are anæsthetised, or after section of the spinal cord. The section of the cord must be made sufficiently high up, so that they are no longer able, by the activity of the few muscles over which they still have control, to keep up the temperature of their tissues.

W. D. H.

The Minimum Amount of Nitrogen required by Human Beings. By LOUIS LAPICQUE and CH. MARETTE (*Compt. rend. Soc. Biol.*, 1894, 273—275).—Two experiments are recorded; in both, the daily ration of albumin was 57 grams. In the first case, where the experiment lasted 10 days, the excreta contained 9·15 grams of nitrogen, corresponding with 58·5 grams of albumin. There was thus a daily deficit of 1·5 grams of albumin, and a loss of body weight in the 10 days of 500 grams. In the second case, the experiment lasted eight days, the body weight did not change, and the daily excretion of nitrogen was 8·28 grams, corresponding with 53·7 grams of albumin, or a daily assimilation of 3·4 grams of albumin. The conclusion drawn is that a little more than 7 grams of nitrogen *per diem* is about enough to maintain nitrogenous equilibrium.

W. D. H.

Peptic Digestion. By FERDINAND KLUG (*Pflüger's Archiv*, 1895, **60**, 43—70).—The following are the results of this investigation. Successive extracts of the same mucous membrane possess different activities, the later being more active than the earlier ones. The activity of the first extract is, however, increased by dilution with weak hydrochloric acid, or by allowing it to digest itself for 24 hours. For experiments on artificial digestion, boiled white of egg is recommended as the best; this, however, already contains about 0·7 per cent. of deutero-albumose. Ammonium sulphate and sodium chloride retard the course of the digestion: the latter, if present to a greater extent than 0·5 per cent.

The quantity of pepsin has an important influence; the best is from 0·5 to 0·01 per cent. of the pepsin solution. With greater or less concentrations, the activity lessens; still, digestion does occur with a pepsin percentage of 0·005. Dog's pepsin, with a concentration of 0·01 per cent., is more active than pig's or ox pepsin similarly diluted; the optimum percentage for these two animals is 0·1

The optimum percentage of hydrochloric acid is 0·5 to 0·6. Gastric juice with less than 0·1 per cent. of hydrochloric acid does not act on white of egg. The best artificial juice therefore contains 0·1 per cent. of pepsin and 0·6 per cent. of hydrochloric acid. Twenty c.c. of such a juice will dissolve 6 grams of hard-boiled white of egg within 10—15 hours. Digestion proceeds most rapidly in the first four hours. Syntonin and albumoses appear five minutes after the commencement of the digestion. Peptone makes its appearance with dog's pepsin in 20—40 minutes, with the pepsin of ox and pig in four hours. Dog's pepsin also forms more peptone in the same time than the other pepsin. It is even suggested that different pepsins exist.

Digestion ceases at 0°; it increases with the temperature, reaching its maximum between 50° and 60°; it then becomes less active, and ceases entirely at 80°. Syntonin and albumoses appear simultaneously; syntonin, however, is not regarded merely as a product of the hydrochloric acid, but, like albumoses and peptone, is the result of the activity of pepsin hydrochloric acid. The paper is illustrated by charts and tables. In the estimation of peptone, the spectrophotometer applied to the biuret reaction was found to give good results. W. D. H.

Pancreatic Digestive Products of Albumin. By MARCELLUS NENCKI (*Ber.*, 1895, **28**, 560—567).—Finely divided pancreas was treated with water and a little chloroform at the ordinary temperature for three days; the liquid was boiled, the coagulated albumin separated, and the cold filtrate treated with mercuric chloride. Xanthine, guanine, hypoxanthine, and adenine-hypoxanthine were isolated from the precipitate. It has been previously shown that with picric acid instead of mercuric chloride, glutine and pentamethylenediamine picrates are deposited. The filtrate from the mercuric chloride precipitate, when concentrated, deposits tyrosine, and then, by the cautious addition of bromine water, proteïnochromogen, which, although apparently homogeneous, consists of at least two substances which could not be completely separated; one of these is red, contains Br 27, S 0·5 per cent., the other is brown, and contains Br 20·5, S 2·2 per cent. The former, in alcoholic solution, shows a characteristic absorption band in the green. When fused with potash, the bromine compound yields scatole, pyrroline, and indole. Attention is drawn to the similarity between the bromine derivatives and other animal pigments, both in composition (calculated as free from bromine) and in the decomposition products. This being the author's first communication on proteïnochromogen, the statement in the German edition of Halliburton's text-book of chemical physiology, that he has previously alleged this compound to be a naphthylamine, is incorrect. J. B. T.

Glycogen in the Blood. By MAURICE KAUFMANN (*Compt. rend.*, 1895, **120**, 567—568).—The statement of Salomon, Huppert, and Czerni is confirmed that glycogen is a constituent of normal blood. The blood of horse, ox, and dog was examined. The blood of animals rendered diabetic by extirpation of the pancreas contains much more glycogen than that of normal animals; in some cases, 20 times as much, namely, 500 milligrams instead of 25 milligrams per litre. This explains the accumulation of glycogen which has been noted in the capillary network and tissues of the nerve centres and kidney, and the presence of glycogen in the urine, which facts have been noted in diabetic patients. W. D. H.

Sugar and Muscular Work. By JOSEF SEEGEN (*Chem. Centr.*, 1894, ii, 795; from *Centr. Physiol.*, **8**, 417—422).—The work of Chauveau and Kaufmann on this subject is criticised. Their conclusions rest chiefly on analyses of the arterial and venous blood of muscle; but the differences in the amount of sugar between the two, both for resting and active muscle, are stated to be so small as to come completely within the limits of experimental error. Further, if the source of muscular energy is sugar, one arrives at curious arithmetical results, like the following :—A dog weighing 40 kilos., and containing 16 kilos. of muscular tissue, would need, in the 24 hours, 840 grams of sugar if at rest, 3230·4 grams of sugar if doing work; in order to obtain this from meat, the resting dog would have to take 2·12 kilos., and the working dog 9·7 kilos. daily.

W. D. H.

Oxidising Action of Animal Tissue. By FRANZ RÖHMANN and WILHELM SPITZER (*Ber.*, 1895, **28**, 567—572).—The oxidation of stable substances such as fats, carbohydrates, &c., in the body, has been compared by Hoppe-Seyler to the action of palladium hydrogenium, the nascent hydrogen decomposing an oxygen molecule and combining with 1 atom, whilst the second attacks the oxidisable compound. M. Traube dissents from this view, and considers that the tissues act in a similar manner to certain finely-divided metals or salts, which undergo no apparent change but are able to cause the evolution of oxygen from many compounds that contain it. If this theory is correct, certain dyes, which are only slowly acted on by air, should be much more readily oxidised when treated with animal tissue. α-Naphthol and paraphenylenediamine, or dimethylparaphenylenediamine, in dilute alkaline solution, metatolylenediamine, and paraphenylenediamine, or dimethylparaphenylenediamine, dimethylparaphenylenediamine, and dimethylaniline, readily oxidise when treated with fresh well washed liver. The reaction may be easily shown by dipping a paper into the mixed solutions and rubbing with the liver; wherever this is placed, the colour is developed. The liver must be taken from an animal recently killed; if it is then finely-divided and treated with alcohol and ether, it retains its activity for an indefinite period. The active substance is unknown, but is a characteristic constituent of the cells, W. Spitzer having shown that dextrose is rapidly oxidised both by red and white corpuscles, whilst blood-serum is without action. A strongly reducing substance is also present which is not decomposed by boiling, and is, therefore, not identical with the oxygen carrier, as Hoppe-Seyler supposes; its presence is necessary for the production of the above colours, as tissue from animals dead some time is unable to induce oxidation.

J. B. T.

Fibrinogen and Fibrin. By MAURICE ARTHUS (*Compt. rend. Soc. Biol.*, 1894, 306—309).—It is found that the weight of fibrin produced in oxalated plasma by adding a calcium salt is less than the weight of fibrinogen obtained by weighing the heat coagulum at 56°, and therefore considerably less than the total quantity of fibrinogen, which does not all come down at 56°, as Hammarsten first showed. Hence, in the formation of fibrin from fibrinogen there must be a decomposition of the latter.

W. D. H.

Fibrinogen and Fibrin. By GEORGES HAYEM (*Compt. rend. Soc. Biol.*, 1894, 309—310).—In reference to Arthus' work (see preceding abstract), it is pointed out that fibrinogen is not a well characterised substance, and that perhaps varieties exist. For instance, with plasma, the amount of fibrinogen depends on the manner in which decantation is performed and heat is applied. In lymph, the quantity of fibrinogen coagulated at 56° is notably less than that of fibrin. In inflammatory dropsical fluids, the difference is greater but in the same direction. In transudations which are not spontaneously coagulable, although heating to 56° destroys their power of coagulating on the addition of serum, it is stated to produce no coagulum of fibrinogen.

W. D. H.

Coagulation of Fibrinogen. By EDWARD A. SCHÄFER (*Proc. physiol. Soc.*, 1895, 18—20).—Lilienfeld (this vol., ii, 52), states that if fibrinogen is prepared pure by Hammarsten's method and dissolved in dilute sodium chloride solution, the addition of acetic acid produces a precipitate; this he terms thrombosin; after washing with water the precipitate is dissolved in a little sodium carbonate solution; the addition of calcium chloride to this produces a coagulum of fibrin.

In the present research, it is shown that in this respect fibrinogen resembles thrombosin in spite of Lilienfeld's assertion to the contrary, and, therefore, further evidence is necessary that thrombosin and fibrinogen are different substances.

Further, Lilienfeld does not prove that nucleo-albumin does not enter into the reaction; for it is impossible to prepare a fibrinogen which does not leave a residue on gastric digestion. The fibrin prepared from such pure fibrinogen leaves a similar residue. Lilienfeld asserts that fibrinogen may itself be a nucleo-albumin, but the amount of residue is small, and it is more probable that the source of the phosphorus-containing digestion residue is nucleo-albumin, which has clung to the fibrinogen, and its presence explains the fact that addition of calcium chloride is all that is necessary for fibrin formation.

Blood plasma slowly coagulates, yielding fibrin even when oxalated; if it is assumed that calcium is a necessary component of fibrin, we must conclude that fibrinogen can slowly take it up even in the presence of soluble oxalates. W. D. H.

Physiological Action of Extract of Suprarenal Capsules. By GEORGE OLIVER and EDWARD A. SCHÄFER (*Proc. Physiol. Soc.*, 1895, 9—14).—An aqueous, dilute alcoholic, or glycerol extract of suprarenal capsules, when intravenously injected in small quantities into dogs or rabbits, produces (1) an extreme contraction of the arteries; (2) a rise of arterial pressure in spite of cardiac inhibition, but which is increased by section of the vagi; (3) central vagus stimulation leading to standstill of the auricles, although the ventricles continue to contract with a slow independent rhythm; (4) acceleration and augmentation of the heart's beat, best marked in the auricles after section of the vagi; (5) respiration is slightly shallower. The effects last while the injection lasts, but do not produce death in dogs. The peripheral constriction of the arteries is shown by the plethysmograph applied to the limbs, or the oncometer applied to the kidney. Stimulation of the depressor nerve fails to produce its usual result while the injection lasts. On the isolated frog's heart, solutions of 5 per cent. are necessary to produce results. The effect on voluntary muscles is not marked, but on electrical stimulation through their nerves there is delay in relaxation. It is considered probable that the active material is taken up by and stored within the muscles. The toxic properties are possessed by the medulla not by the cortex of the suprarenal capsules. The suprarenals of man act similarly except in cases of Addison's disease, where they give an entirely negative result. Gastric digestion does not impair the activity of the extract.

The evidence obtained leads to the view that the suprarenal bodies are secretory rather than destructive, and the secreted product is in all probability of great physiological importance for maintaining the tonicity of the muscular tissues in general, and especially of the heart and arteries. W. D. H.

The Physiologically Active Substance occurring in the Suprarenal Gland. By B. MOORE (*Proc. Physiol. Soc.*, 1895, 14—17).—This substance is probably a powerfully reducing material found only in the medulla of the gland, and first described by Vulpian. It gives a dark green or blue colour with ferric chloride, passing through purple to a dark red on the addition of ammonia or sodium carbonate. With chlorine, bromine, or iodine water, peroxide of hydrogen or alkalis in the presence of oxygen, it gives a rose-red coloration discharged by sulphide of hydrogen or ammonium.

It is insoluble in organic solvents like alcohol, ether, or benzene; it is soluble in water and dilute acids. It is found only in the suprarenal capsule, or after death in the blood of the suprarenal vein. Its presence in physiologically active extracts was constant; when absent, the extracts gave a negative physiological result.

It has not yet been separated, and its characters are largely negative; it has not been identified. It is not attacked by acids, or by boiling for some minutes, but it is destroyed by alkalis, by oxidising agents and by prolonged boiling. It is not precipitated by alcohol, saturation with ammonium sulphate, by mercuric chloride, potassio-mercuric iodide, or tannic acid. It does not reduce Fehling's solution, even after boiling with mineral acids, nor does it form a crystalline compound with phenylhydrazine. It is not volatile either alone or with aqueous vapour. It dialyses freely through parchment paper, and the highly active dialysate is free from proteïds.

W. D. H.

Proteïds of Suprarenal Capsules. By D. N. NABARRO (*Proc. Physiol. Soc.*, 1895, 17—18).—The proteïds dissolved out by 5 per cent. solutions of magnesium sulphate are chiefly globulins and nucleo-albumins. Pepsin and peptone are absent, and albumin is only present in small quantities. W. D. H.

Urea in Arterial and Venous Blood. By MAURICE KAUFMANN (*Compt. rend. Soc. Biol.*, 1894, 93—95).—By experiments on horses and dogs, using Gréhant's method of estimation, it is found that the percentage of urea in arterial and venous blood is practically the same. The small differences noted come within the limits of experimental error. If differences exist, they would be expected to be very small; these experiments should not lead to the conclusion that no urea is formed in limbs or head. W. D. H.

Absorption and Elimination of Glycero-phosphoric acid. By GUISTO PASQUALIS (*Chem. Centr.*, 1894, ii, 709; from *Annali Chim. Farm*, **20**, 145—154).—Calcium glycero-phosphate is easily digested and passes quickly into the circulation. Normal calcium phosphate is digested but with greater difficulty, and goes more slowly into the circulation. Glycero-phosphoric acid passes at least in greatest part as such into the blood and is excreted in the urine as phosphoric acid; the decomposition of glycero-phosphoric acid into glycerol and orthophosphoric acid must occur in some one organ. Glycero-phosphoric acid is regarded as of great therapeutic and physiological value. W. D. H.

Saturation of Normal Urine with Neutral Salts. By ARTHUR EDMUNDS (*J. physiol. Chem.*, 1895, **17**, 451—454).—Saturation of horse's or human urine with ammonium sulphate causes a precipitation of ammonium urate. The precipitate comes down less rapidly than that caused by ammonium chloride. The precipitate is tinged pink, and is mixed with some calcium sulphate. Saturation of human urine with magnesium sulphate also causes a small precipitate which is tinged with urobilin, but is chiefly inorganic in nature, consisting of calcium sulphate and magnesium phosphate. After saturation with this salt, the urine no longer gives the tests for calcium. With horse's urine, the precipitate produced by saturation with magnesium sulphate is more abundant, and differs from that obtained from human urine in containing very little phosphate, but abundance of carbonate of magnesium. Horse's urine is very poor in phosphates.

The mere appearance of a precipitate on saturating urine with these salts does not, therefore, indicate the presence of proteïd, and may constitute a source of error in the quantitative estimation of the varieties of proteïd (albumin and globulin) present in cases of albuminuria. Noël Paton's latest method, however, does not introduce this error; the total proteïd is estimated by weighing the heat coagulum; another specimen is half saturated with ammonium sulphate to precipitate globulin; the albumin is estimated by weighing the heat coagulum in the filtrate, and the amount of globulin is obtained by difference. Half saturation of normal urine by ammonium sulphate causes no precipitate in normal urine. Saturation of normal urine with sodium chloride or sodium sulphate produces no precipitate.
W. D. H.

Toxicological Investigation of Potassium Silicate. By P. LAGUARDIA (*L'Orosi*, **17**, 217—224).—From experiments made on rabbits, the author finds that a dose of 1—2 grams is toxic, the substance acting like caustic poisons such as the alkali oxides, hydroxides, and carbonates; an examination of the liver, bile, and urine, shows that the silicate is not absorbed by the system. In cases of poisoning by potassium silicate, the chemical examination, a complete schem for which is given in the paper, should be made on the stomach and its contents, the intestines, the vomit, and the fæces. W. J. P.

Physiological Action of Acetonitrile and its Homologues. By S. Lang (*Chem. Centr.*, 1894, ii, 796; from *Arch. exp. Path. Pharm.*, **34**, 247—258).—After feeding a dog, weighing 18 kilos., with from 0·5 to 9 c.c. of acetonitrile mixed with its food, the urine gave a red colour on the addition of ferric chloride. This depends not exclusively on the presence of acetic acid, but is also due to ammonium thiocyanate. Toxic symptoms (vomiting) were only observed when more than 5 c.c. of acetonitrile was given. The same applies to rabbit's urine. There must therefore be a separation of the two carbon atoms, and the CN-group so split off unites with the group SH. The CH_3-group appears in the urine as formic acid. Propionitrile, butyronitrile, and capronitrile lead constantly to the appearance of thiocyanate in the urine; the corresponding fatty acid was not found; the organism probably exercises a greater power of oxidising ethyl, propyl, and butyl groups than it possesses over methyl.

W. D. H.

Change of Cyanogen Compounds in the Body. By W. Pascheles (*Chem. Centr.*, 1894, ii, 797; from *Arch. exp. Path. Pharm.*, **34**, 281—288).—The work of Lang (see preceding abstract) led to the present investigation, which relates to the action of living tissues on cyanogen compounds. Sodium cyanide was mixed with the freshly-removed tissues and organs; it was found that both muscle and ox liver possess the power of decomposing a portion of the cyanide, especially the liver, particularly at the body temperature. By union with sulphur, thiocyanate is formed. The same occurs with albumin, the loosely combined sulphur playing an important part in the reaction. Alkali albumin contains no loosely combined sulphur, acid albumin does; the latter reacts with cyanides in the manner described, the former does not. Cystin can also change cyanogen into thiocyanate. W. D. H.

Physiological Action of Chlorocaffeïne and Cyanocaffeïne. By John W. Pickering (*J. Physiol.*, 1895, **17**, 395—401).—The introduction of an atom of chlorine into the caffeïne molecule considerably modifies its physiological action, as tested on the hearts of embryo chicks, frogs, and human beings. It appears that a chemical stimulus or depressant may exert its action, due to one or more molecular groups in its substance; and that one group of atoms may modify the physiological action of other groups of atoms in the same molecule. This apparently occurs in the case of chlorocaffeïne, the three methyl groups would tend to induce tonic contraction of the heart muscle, and the chlorine atom to produce an atonic condition. Chlorocaffeïne (chlorotrimethylxanthine) produces far less tonic contraction of the heart than caffeïne itself. Thus here is a case of physiological antagonism going on in the interaction of the parts of one molecule and living contractile tissue.

In the introduction of cyanogen into the caffeïne molecule, the cyanogen overpowers the physiological action of the three methyl groups, and the cyanocaffeïne acts more like a cyanogen derivative than a xanthine derivative, being almost immediately fatal to the heart of chick and frog; there is no evidence of tonic contraction at all, and the heart dies in extreme diastole.

The possibility of the living tissue decomposing the chlorocaffeïne and cyanocaffeïne into free chlorine, cyanogen, and caffeïne respectively was not overlooked, but tests failed to give evidence of these substances.

A solution of caffeïne in chlorine water acts differently, the free chlorine being very toxic to the heart. Chlorocaffeïne is a powerful diuretic and apparently also a cerebral stimulant. W. D. H.

Influence of Saline Media on Tadpoles. By SYDNEY RINGER and ARTHUR G. PHEAR (*J. Physiol.*, 1895, **17**, 423—432).—Distilled water kills tadpoles in from 2—6 hours; paralysis is quickly followed by disintegration; indeed signs of desquamation may be observed before movement has entirely ceased. Certain salts when added in minute quantities such as occur in river water, sustain motion in some cases for many days. Some of these sustaining salts are, however, poisons, such as hydrocyanic acid, potassium cyanide, and normal potassium oxalate.

Carbonates, citrates, and tartrates also sustain life. A solution of 0·00025 per cent. of potassium ferrocyanide will sustain life for six days. Sodium sulphate, phosphate, sulphite, and arsenate, and ammonium oxalate are not so efficacious, but are superior to distilled water. Potassium chloride, sulphate, nitrate, chlorate, acetate, oxalate (KHC_2O_4) and phosphate, sodium acetate, and calcium chloride and sulphate kill as soon as or sooner than distilled water. Extremely dilute acids and alkalis sustain life also. A large number were tried; the dilution in the cases of hydrochloric, sulphuric, and hydrocyanic acids were 1 to 70,000, 200,000, 500,000 respectively. The explanation advanced is that the salt or acid acts not by being absorbed in appreciable doses, especially in the case of poisons, but merely by maintaining the integrity of the cuticle, and preventing the disintegration which is the cause of death produced by distilled water. On increasing the dose beyond a certain limit, the poisonous action of the salt asserts itself. W. D. H.

Influence of Saline Media on Tubifex Rivulorum. By SYDNEY RINGER and ARTHUR G. PHEAR (*Proc. Physiol. Soc.*, 1895, 23—27).—A similar investigation with similar results to that recorded in the foregoing research on tadpoles. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Detection of Hydrogen Peroxide in Green Plants. By A. BACH (*Compt. rend.*, 1894, **119**, 1218—1221).—Perchromic acid in ethereal solution containing a free acid, readily converts aniline into a violet colouring matter, and hence a very dilute solution of potassium dichromate, mixed with aniline and a free acid, can be used for the detection of hydrogen peroxide.

The best results are obtained with a solution containing 0·03 gram of potassium dichromate and 5 drops of aniline per litre.

Experiments with different acids in various proportions show that oxalic acid gives the most rapid and distinct results. Since potassium dichromate in presence of a free acid slowly oxidises aniline, even when no hydrogen peroxide is present, it was necessary to determine the conditions which enable the one action to be distinguished from the other. The action of oxalic acid on the reagent is considerably retarded by dilution; 4 drops of a 5 per cent. solution of the acid, added to 5 c.c. of the reagent, gave a coloration after about an hour, but if the reagent was previously diluted with an equal volume of water the coloration did not appear until after 15 hours. The rate of action of the oxalic acid also decreases as the proportion added is reduced; 20 drops of the 5 per cent. solution, added to 5 c.c. of the reagent, diluted with an equal volume of water, gave a coloration after 12 minutes; whilst with 2 drops, 36 hours was necessary, and with 1 drop, 78 hours. In presence of hydrogen peroxide, 1 drop of the acid solution produces a coloration in from 10 to 30 minutes, and there is therefore a sufficiently wide margin between the two reactions.

In practice, 5 c.c. of the dichromate and aniline solution is mixed with 5 c.c. of the liquid to be tested, and 1 drop of the 5 per cent. solution of oxalic acid. A blank experiment may be made at the same time.

Nitrous acid and nitrogen oxides are without action on the reagent, but the coloration is produced by hypochlorous acid and hypochlorites, and by chlorine and chlorine oxides; but of a large number of non-oxidising substances examined, tannin alone was found to reduce the sensitiveness of the reagent.

Twenty-five grams of the leaves collected in the middle of the day are moistened with 75 c.c. of water containing 1 gram of oxalic acid per litre, the vessel being kept in the dark. Five c.c. of the liquid is withdrawn from time to time, and tested in the manner described.

Experiments made during October showed the presence of hydrogen peroxide in the following 18 plants :—*Brassica asperifolia*, *B. oleifera*, *Daucus carota*, *Beta vulgaris*, *Geranium rotundifolium*, *Hedera helix*, *Cerasus laurocerasus*, *Aster*, *Tropæolum pentaphyllium*, *Chrysanthemum balsamica*, *Mercurialis annua*, *Urtica*, *Caltha palustris*, *Vicia faba*, *Papaver rhœas*, *Sisymbrium nasturtium*, *Dianthus caryophyllus*, *Apium petroselinum*, *Fragaria vesca*. *Lactuca sativa*, and *Vicia* gave doubtful results, and *Medicago sativa*, *Chicorium intybus*, *Avena sativa*, *Viola odorata*, and *Lilium bulbiferum* gave negative results (compare this vol., ii, 26). C. H. B.

Atmospheric Ozone. By J. Peyrou (*Compt. rend.*, 1894, **119**, 1206—1208).—Experiments were made during the months of July, August, September, and October with a view to ascertain what influence is exerted by vegetation on the proportion of ozone present in the atmosphere. Iodised starch paper was exposed at a height of 0·5 metre above the surface of the soil in an arable field in fallow, and in an adjacent field with a vigorous crop of lucern, the two stations being 200 metres apart. In 172 cases out of 197, the paper placed above the growing crop indicated more ozone than the paper above the fallow, the differences in some instances being considerable; in 14 cases, both papers gave the same results, but on these days there was a dry wind unfavourable to vegetation; in 11 cases, the paper above the fallow indicated more ozone than that above the crop. Similar experiments, in which one paper was placed above bare soil and another over a young crop of radishes, gave similar results; in 22 cases, the paper over the growing crop indicated more ozone than that over the bare soil, whilst only in two instances was the reverse the case, and then there was a high wind. Confirmatory evidence was obtained in a greenhouse, more ozone being indicated in the immediate neighbourhood of plants than elsewhere. Any condition, such as the proximity of decomposing organic matter, which tends to destroy ozone, reduces the indications of the paper.

The quantity of ozone present is greater, the greater the activity of the surrounding vegetation, and this agrees with Houzeau's observation that the proportion of atmospheric ozone is highest in spring. The author has previously shown that there are two periods in the day when plants show a maximum absorption of oxygen (Abstr., 1889, 641—642). Observations made every two hours during 15 days in August, show that during the day the proportion of ozone is practically constant, but in the evening, from 6 to 9 P.M., there is, as a rule, little or no ozone in the atmosphere. Other experiments showed that, as a rule, the proportions of ozone in a large park containing a number of fir trees and in a garden in the open country were practically identical, whilst there was a higher proportion over a field near the park. These latter results do not agree with some early observations of Cloez.

Throughout the experiments from July to October, ozone was always recognisable in the air of the country during both day and night; but in Paris, even in the neighbourhood of trees, ozone was only recognisable during October when there were high winds.

C. H. B.

Note by Abstractor.—It seems not improbable that the results ascribed by the author to ozone are really due to hydrogen peroxide. (See Bach, Abstr., 1894, ii, 186—187, and this vol., ii, 26.)

Chemical Composition of Kola-nut. By C. UFFELMANN and A. BÖMER (*Zeit. angw. Chem.*, 1894, 710—713).—The authors have fully analysed 12 varieties of kola-nut, and tabulated the results.

The caffeïne was estimated by boiling with water containing 5 per cent. of sulphuric acid, and further treating according to Mulder's directions. The starch was estimated by first boiling under pressure and then inverting. The ethereal extract, containing a little caffeïne, was obtained by six or eight hours' extraction of the finely-powdered substance. The tannic acid was estimated by boiling

5 grams with 200 c.c. of water for one hour; the liquid was then diluted to 500 c.c., and, in 200 c.c. of the filtrate, the acid was estimated by Fleck's method. Ready-formed sugar was only present in traces.

L. DE K.

Phosphate from Grand-Connétable. By AMBROISE ANDOUARD (*Compt. rend.*, 1894, **119**, 1011).—The phosphate from Grand-Connétable, an islet to the east of Cayenne, is amorphous, light, and very porous, and has a reddish-yellow to deep brick-red colour. It has the composition P_2O_5, 39·10; SiO_2, 1·70; SO_3, 0·06; CO_2, traces; Cl, traces; Al_2O_3, 25·59; Fe_2O_3, 8·03; CaO, 1·40; MgO, traces; H_2O (at 105°), 21·24; H_2O (at a red heat), 2·50; residue, 0·38 = 100·00. The water is chiefly in a state of combination; determinations of hygroscopic moisture should be made somewhat below 100°.

The phosphate is insoluble in cold water, but is very soluble in acids and in a solution of ammonium citrate, and hence is readily assimilable. It has a rapid effect on crops, and may find useful employment in agriculture, although at present it is chiefly used for the manufacture of alum.

C. H. B.

Analytical Chemistry.

Simple Apparatus for Gas Analyses. By CARL KIPPENBERGER (*Zeit. angw. Chem.*, 1894, 714—715).—The author has described an apparatus (Abstr., 1894, ii, 477) for the measurement of gases. In using it, the gas to be measured must be expelled from the generating flask by means of water or else by means of another gas soluble in the liquid with which the apparatus is charged. The apparatus may, however, also be used in the analysis of pyrolusite or bleaching powder by simply decomposing these in the generating flask with hydrogen peroxide and noticing the amount of water displaced. The manipulation which becomes, of course, slightly different will be easily understood by those using the apparatus.

L. DE K.

Litmus and Methyl-orange as Indicators. By GEORG LUNGE (*Zeit. angw. Chem.*, 1894, 733—738).—Reinitzer (this vol., ii, 134) has attempted to prove the superiority of litmus over methyl-orange in volumetric analysis. The author admits that in very dilute solutions litmus may prove the more delicate indicator, but, in ordinary practice, the results are almost identical.

L. DE K.

Detection and Estimation of Chlorine in presence of Iodine. By P. N. RAIKOW (*Chem. Zeit.*, 1894, **18**, 1661).—Phenylhydrazine is dissolved in dilute sulphuric acid and mixed with an excess of copper sulphate. If sufficient acid is present, the mixture will remain clear. Added to a soluble chloride containing an iodide, the latter causes a bulky, brownish precipitate containing all the iodine. Chlorine may then be tested for in the filtrate by adding silver sulphate.

The precipitate will yield its iodine to boiling aqueous potash, which may then be qualitatively or quantitatively estimated as usual.

Bromides also give a precipitate with the reagent, but too soluble to admit of quantitative estimation. It cannot, however, be separated from the iodine compound by simple washing. L. DE K.

Estimation of Nitrogen in Feeding Stuffs by Kjeldahl's Process. By GERLACH and SÜVERN (*Chem. Zeit.*, 1894, **18**, 1902—1903). —It has been mentioned of late that when applying Kjeldahl's process to the analysis of cotton-seed meal, a two or three hours' boiling with sulphuric acid and mercury is insufficient to convert all the nitrogen into ammonia, but that addition of phosphoric anhydride will hasten the operation.

The authors having made a large number of experiments conclude that there is no necessity for adding any phosphoric anhydride, and that two or three hours' boiling is amply sufficient. L. DE K.

Estimation of Nitrogen in Nitro-cellulose, &c. By DUSCHAN STANOJEWITSCH (*Zeit. angw. Chem.*, 1894, 676—678).—The apparatus used by the author is a combination of Schloesing's apparatus with Lunge's nitrometer. The substance to be tested is introduced into the decomposing flask containing 50—60 grams of mercury, and the air is then expelled from the flask by means of a current of carbonic anhydride, which is in turn absorbed by having the nitrometer filled with aqueous soda. Finally, sulphuric acid is admitted into the flask, and the liberated nitric oxide collected and measured in the nitrometer, the last traces being expelled from the flask by a current of carbonic anhydride. L. DE K.

Estimation of Nitrogen and Phosphoric acid. By HUGO NEUBAUER (*Zeit. angw. Chem.*, 1894, 678—679).—The author recommends the following process :—Ten grams of the manure is dissolved in a 500-c.c. flask, in 50—60 c.c. of sulphuric acid; 2 grams of mercury and a little paraffin are added, and the mixture boiled until colourless. After cooling, the liquid is diluted with water up to the mark; 1 c.c. of brine is added, and the whole is then filtered. Fifty c.c. of the filtrate is then used for the estimation of the phosphoric acid by the citrate method, and in another 50 c.c. the ammonia is estimated.

The phosphatic precipitate is practically free from mercury, and, therefore, does not, on ignition, give off any poisonous fumes.

L. DE K.

Estimation of Citrate-soluble Phosphoric acid in Basic Slag and Mineral Phosphates. By PAUL WAGNER (*Chem. Zeit.*, 1894, **18**, 1153—1154).—The following reagents are required. (*A*) A solution of ammonium citrate, containing 160 grams of citric acid and 28 grams of nitrogen per litre; (*B*) a solution containing 150 grams of citric acid and 23 grams of nitrogen per litre; (*C*) a molybdenum solution, made by dissolving 125 grams of molybdic acid in a sufficiency of 2·5 per cent. ammonia, and, after adding 400 grams of ammonium nitrate, diluting to 1 litre. The solution is then poured into 1 litre of nitric acid (sp. gr. 1·19), and, after standing for 24 hours at 35°, it is filtered.

1st Method.—(*a*) *Estimation of the Alkalinity of the Sample.*—Five grams of phosphate flour is put into a 500-c.c. flask, and this is filled up to the mark with a 1 per cent. solution of citric acid. After shaking for half an hour in a shaking apparatus, 50 c.c. of the filtered liquid is titrated with N/4 sodium hydroxide, using phenolphthaleïn as indicator, and the alkalinity of the sample is then found by a simple calculation. (*b*) *Estimation of Citrate-soluble Phosphoric acid.*—Five grams of the phosphate flour is put into a 500-c.c. flask, and mixed with 200 c.c. of water. After first adding sufficient 5 per cent. citric acid solution to neutralise the alkalinity, 200 c.c. of ammonium citrate (*A*) is added, and then water up to the mark. After shaking for half an hour, the liquid is filtered, and 50 c.c. of the filtrate is mixed with 100 c.c. molybdate solution (*C*), heated to 80°, and treated as usual.

2nd Method.—The alkalinity need not be estimated, but the sample is treated with 200 c.c. of water and 200 c.c. of ammonium citrate (*B*). After adding water up to the mark, the operation is conducted as before. There is not much to choose between the two processes.

L. DE K.

Kalman and Meissel's Process for the Volumetric Estimation of Phosphoric acid in Superphosphates. By CHARLES GLASER (*Chem. Zeit.*, 1894, **18**, 1533—1534).—The author has slightly modified this process. Two grams of the sample is repeatedly lixiviated with water, and the liquid is made up to 250 c.c., and filtered. Fifty c.c. is then titrated with N/10 soda, using methyl-orange as indicator until the red colour has entirely disappeared; this, however, requires some practice. Each c.c. of soda = 0·0071 gram of free P_2O_5. After adding a solution of calcium chloride and a little phenolphthaleïn, the titration is continued until the liquid shows alkalinity; that this soon disappears makes no difference. Each c.c. of soda represents 0·0035 gram of P_2O_5 present as mono-calcium phosphate.

L. DE K.

Estimation of Sulphur and of Chlorine with Sodium Peroxide. By ALBERT EDINGER (*Ber.*, 1895, **28**, 427—428).—The determination of sulphur in organic compounds is readily effected by means of sodium peroxide; chlorine in presence of sulphur can also be estimated in this way. A convenient method of analysing sulphonic acids and mercaptans is to evaporate a 4 per cent. solution of sodium peroxide with the substance in a platinum dish, and, after gently igniting the residue, extracting it with a concentrated solution of sodium peroxide. Chlorine in tetrachloroquinone may be determined in a similar manner, whilst both the platinum and chlorine in platinochlorides of quinoline derivatives can be estimated in one operation.

M. O. F.

Estimation of Sulphur in Pig-Iron and Steel. By JOS. SPÜLLER and S. KALMAN (*Chem. Zeit.*, 1894, **18**, 2039—2040).—The sample is dissolved in hydrochloric acid (sp. gr. 1·17), and the gases are passed through a 3 per cent. solution of sodium peroxide. The last traces of hydrogen sulphide are removed by means of a current of air which has been purified and also deprived of most of its oxygen by passing it through solutions of mercuric chloride and alkaline pyrogallol.

The alkaline solution is first boiled, and traces of undecomposed peroxide are decomposed by adding potassium permanganate. Any excess of the latter is decomposed by adding hydrochloric acid and a trace of oxalic acid, and the liquid is then precipitated with barium chloride. L. DE K.

New Process for Estimating Potassium. By H. SCHWEITZER and E. LUNGWITZ (*Chem. Zeit.*, 1894, **18**, 1320—1322).—The authors use the following process when analysing potash mixtures containing much sulphate; for instance, kainite, superphosphates, &c. The substance is dissolved in water and mixed with an excess of solution of barium oxalate in hydrochloric acid to precipitate the sulphuric acid. After boiling, any iron is oxidised by means of a few drops of hydrogen peroxide, and the iron, calcium, and aluminium, together with any phosphoric acid, and also the excess of barium oxalate, is precipitated by ammonia. The filtrate is evaporated, the residue calcined, and the potassium estimated by means of platinic chloride, as usual. L. DE K.

Estimation of Calcium and Magnesium Carbonates in Soils, Ashes, &c. By ALBERT TRUBERT (*Compt. rend.*, 1894, **119**, 1009—1010).—A given weight, p, of the dried substance is treated with dilute hydrochloric acid, and the volume of carbonic anhydride liberated is measured, preferably by conducting the operation in a large flask and collecting the air displaced. The reduced volume, V, of gas, divided by 11·12377, gives the number of c.c. of normal hydrochloric acid necessary for the exact decomposition of the carbonates. The same weight, p, of the dried substance is treated with this volume of normal acid, and when decomposition is complete, the residue is washed, dried, and weighed. The difference between p and the weight of the residue, p', is the sum of the weights of the two carbonates, p_1. Then if x is the volume of carbonic anhydride liberated from the calcium carbonate, and y the volume from the magnesium carbonate, $V = x + y$. The weight of calcium carbonate in milligrams is 4·4948 x, and of the magnesium carbonate, 3·7756 y. It follows that $p_1 = 4·4948\ x + 3·7756\ y$, and hence $x = p_1 - 3·7756\ V/0·7192$, and the weight c of the calcium carbonate is $c = 6·2497\ p_1 - 23·5963\ V$, and the weight m of the magnesium carbonate is $m = 23·5963\ V - 5·2497\ p_1$.

Another method is to determine (1) the weight of the two carbonates, W, present in, and (2) the volume of carbonic anhydride, V, liberated from, 1 gram of the substance, and (3) the volume, V_1, of carbonic anhydride liberated under similar conditions from the same weight, W, of pure calcium carbonate. The volume V_2 liberated from the same weight of magnesium carbonate is then readily calculated; $V_2 = 50/42\ V_1$. Then $V_2 - V_1 = v$, which corresponds to a weight, W, of magnesium carbonate, whilst $V - V_1 = V'$, which corresponds to the weight p of magnesium carbonate actually present.

The value of p is given by the expression $p = Wv'/v$. The calcium carbonate is obtained by difference. C. H. B.

Separation of Copper from Cadmium, Zinc, and Nickel. By P. N. Raikow (*Chem. Zeit.*, 1894, **18**, 1739).—The author (compare this vol., ii, 242) adds to the mixture an acid solution of hydrazine hydrochloride or sulphate, and then, cautiously, a solution of potassium iodide until precipitation ceases. Copper is completely precipitated, whilst cadmium, zinc, and nickel are not affected. The precipitate may then be decomposed by boiling with dilute nitric acid, and the copper precipitated by aqueous potash. L. de K.

Estimation of Iron and Aluminium in Phosphates. By W. Hess (*Zeit. angw. Chem.*, 1894, 679—683; 701—708).—The author states that the iron-aluminium precipitates obtained in the Glaser-Jones's alcohol process or the acetate method rarely have a constant composition. It is therefore necessary to first weigh the mixed phosphates, and then to estimate the phosphoric acid either by the molybdate or the citrate method. Glaser's statement that the iron-aluminium precipitate is occasionally free from calcium proved erroneous, but it can be got absolutely free by repeatedly redissolving in hydrochloric acid and reprecipitating by ammonium acetate with addition of some ammonium phosphate.

Operating in this manner, the acetate process is better and more convenient than the alcohol method. L. de K.

Estimation of Iron and Aluminium in Phosphates. By Ferdinand Jean (*J. Pharm.*, 1895, [6], **1**, 99—101).—The author recommends the following method as giving very good and trustworthy results. Four c.c. of strong sulphuric acid is heated in a porcelain basin until it begins to fume; about 1 gram of the finely powdered phosphate is added, and the whole stirred. About half a gram of a mixture of equal proportions of nitrate and chloride of potassium is gradually added to oxidise the iron, then 10 c.c. of water, and the whole is boiled for a few moments. To the cooled liquid, 10 c.c. of alcohol is added, the solution filtered off from the precipitated calcium sulphate, &c., and the latter washed with dilute alcohol. The filtrate is heated on a sand bath until the alcohol is driven off, allowed to cool, 20 c.c. of the ordinary citro-magnesia solution added, and the whole made up to 100 c.c. and left for 12 hours, when all the phosphoric acid is precipitated. Twenty-five or fifty c.c. of the clear supernatant liquid is carefully removed with a pipette, introduced into a flask, evaporated to about 10 c.c., and 5 c.c. of fuming nitric acid added, and boiled for 15 minutes, then 5—6 c.c. of strong sulphuric acid added, and the whole reboiled until it becomes of a coffee colour, when a small quantity of the mixture of nitrate and chloride is added, and the heating continued until the solution becomes colourless. In this way, the citric acid is completely destroyed, and the solution has only to be diluted, and the iron and aluminium precipitated with ammonia in the usual way. The whole operation may be completed in half an hour. The magnesium phosphate precipitate in the graduated vessel is collected and weighed as usual as pyrophosphate. L. T. T.

Qualitative Separation of Nickel and Cobalt. By A. VILLIERS (*Compt. rend.*, 1895, **120**, 46—47).—The solubility of nickel sulphide in sodium hydrosulphide, when precipitated by hydrogen sulphide from a solution containing sodium tartrate and sodium hydroxide, and the very dark colour of the solution (this vol., ii, 228), can be utilised for the qualitative separation of nickel from cobalt, but cannot be applied in quantitative analysis. The reaction is very sensitive, and indicates the presence of nickel in many so-called pure cobalt salts.

Ammonium salts, if present, must be removed. In the ordinary course of qualitative analysis, the precipitate produced by ammonium sulphide is treated with dilute hydrochloric acid, and the black residue is dissolved in aqua regia, and tested in the manner indicated after removal of the excess of acid. In very dilute solutions of cobalt, this metal may remain in solution unless a considerable excess of sodium hydroxide has been added (*loc. cit.*).

Nickel may be detected more easily, but with less certainty, by means of its solubility in yellow ammonium sulphide, an excess of this reagent being added to the solution containing ammonium chloride and ammonia, but cobalt will also dissolve if the quantity of sulphur in the ammonium sulphide is considerable. C. H. B.

Note by Abstractor.—The dark colour of the ammonium sulphide filtrate is already very commonly used as a qualitative reaction for nickel.

Analysis of Sour Milk. By MATS WEIBULL (*Chem. Zeit.*, 1894, **18**, 1567—1568).—The author recommends his ammonia process (this vol., ii, 145) for the purpose of collecting daily samples of milk in the same stoppered bottle and then analysing the mixture at a convenient time. L. DE K.

Oils. By G. DE NEGRI and GUIDO FABRIS (*Zeit. anal. Chem.*, 1894, **33**, 547—572; from *Publicazione del Laboratorio Chimico Centrale delle Gabelle, Rom.*, 1891 and 1893).—The authors have had under examination 213 specimens of olive oil from various sources, whereof 160 were extracted by themselves from olives of different varieties, partly by pressure, partly by means of solvents, and upwards of 150 specimens of seed oils (also of their own extraction) of the following kinds:—Earth-nut oil, rape-seed oil, jambo oil, oil of black and white mustard, cress oil, radish oil, camelina oil, oil of Dame's violet, almond oil, apricot oil, peach oil, plum-tree oil, cherry-tree oil, cherry-laurel oil, hazelnut oil, beechnut oil, Tormentilla oil, oil of sesamé, cotton-seed oil, cotton-oil margarin, Brazil-nut oil, sunflower oil, Madia oil, pine oil, poppy oil, pistachio-nut oil, maize oil, grape-seed oil, walnut oil, hemp-seed oil, linseed oil, curcas oil, soy oil, coffee oil, oil of laurel, cacao butter, cocoanut oil, mafura fat, and the oils of the Mahwa-Bassia class.

For each kind of oil they give the extremes of specific gravity at 15°, the freezing point, melting point of the fatty acids, iodine number, saponification number, and rise of temperature on mixing with sulphuric acid, as also the colour reactions with Heydenreich's, Hauchecorne's, Brullé's, Becchi's, Milliau's, Baudouin's, and Schneider's tests, besides special tests in particular cases, and much information as to methods of detecting those oils which are used for adulterating others. For olive oil, they find the specific gravity to vary between 0·916 and 0·918; the melting point of the fatty acids from expressed oils lies between 24° and 27°, that of the acids from oils extracted by solvents, which contain more stearin, between 25° and 29°. The iodine number was in the case of olive oil determined by the use of only a small excess of Hübl's reagent; for the seed oils, a larger excess was used. It was found to be influenced considerably by the variety of the olive and mode of extracting the oil, but very little by the degree of ripeness of the fruit or locality of growth. The limits may be taken as 79·5 to 88, although certain raw unrefined oils gave a number as low as 74·4. The saponification number varied from 185 to 196, but as a rule departed little from 190. The rise of temperature with sulphuric acid, determined with Jean's apparatus, ranged from 32 to 37.

Heydenreich's test consists in letting fall 5 drops of the oil on the surface of pure concentrated sulphuric acid in a porcelain basin, and observing the colours developed during the first three minutes. In Hauchecorne's test, 6 grams of the oil is shaken with 2 grams of nitric acid (of 46·3 per cent.) free from nitrous acid, and the colours are observed after two minutes in the cold, and 20 minutes in boiling water. For Brullé's test, 10 c.c. of the oil with 0·1 gram of egg albumin and 2 c.c. of nitric acid of 1·357 sp. gr. is heated to incipient ebullition. For Becchi's and Milliau's tests see Abstr., 1885, 301, and 1888, 633. Schneider's test consists in saponifying the oil by alcoholic potash and decomposing the soap with dilute nitric acid in presence of silver nitrate, observing the colour at the contact surface of the fatty acids with the aqueous layer. Baudouin's test is given in Benedikt's *Analyse der Fette*, 2nd Ed., 345. With the first four of these tests, olive oil gives, as a rule, only a deep yellow or greenish colour, whilst the seed oils, with the first three reagents, generally give orange-yellow to reddish-brown colours. Unrefined olive oils, which have been extracted by solvents, behave, however, almost exactly like seed oils, and especially give the characteristic Becchi reaction for cotton-seed oil. On the whole, the authors conclude that no single test or determination of constant can be accepted as evidence of the purity of a sample of olive oil, a general view of the reactions and constants being the only means of forming a judgment as to purity.

For the results obtained with the seed oils, the original must be consulted. M. J. S.

General and Physical Chemistry.

Measurement of the Intensity of Light by the Chemical Changes produced in a Mixture of Ferric Chloride and Oxalic acid. By GEORGES LEMOINE (*Compt. rend.*, 1895, **120**, 441—444).—The decomposition of a mixture of ferric chloride and oxalic acid in solution (Abstr., 1891, 965) can be used to determine the intensity of light. Although the decomposition is exothermic, the temperature never rises sufficiently high to cause decomposition by heat alone (Abstr., 1893, ii, 405), and the change ceases as soon as the light is cut off. In order to eliminate the effect of physical absorption, the results with layers of liquid of measurable thickness are calculated to a layer infinitely thin, and the intensity is inversely as the time required to produce decomposition in such a layer. Formulæ for this calculation are given. Results are quoted showing that the intensity as measured by the fraction of total decomposition produced in one minute in an infinitely thin layer was 0·16 on a March day, 0·20 on an April day, 0·31 on a May day, 0·24 to 0·29 on September days, and 0·01 on December days.

The same method was applied to the measurement of the intensity of various coloured lights transmitted through coloured media; in summer, the ratio of the intensity of sunlight transmitted through potassium chromate solution was 0·001—0·007, and that transmitted through blue glass or ammoniacal copper solution was 0·40—0·50. C. H. B.

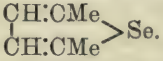
Note.—The use of a mixed solution of ferric chloride and oxalic acid for actinometric purposes is very old, and many actinometers based on its use have been constructed (see Eder, *Handb. f. Photographie*, Part I). C. H. B.

Atomic Refraction of Selenium. By I. ZOPPELLARI (*Gazzetta*, 1894, **24**, ii, 396—407).—The author has determined the refraction

Substance.	Temp.	$P\frac{\mu_D - 1}{d}$.	$P\frac{\mu^2_D - 1}{d(\mu^2_D + 2)}$.	Atomic refractions for	
				μ.	μ^2.
$SeEt_2$	27·5°	53·10	31·45	19·56	10·94
Se_2Et_2	21·6	76·79	44·15	21·57	11·82
SeC_6H_8	26·1	64·63	38·01	19·33	11·18
H_2SeO_4	24·0	29·79	17·41	16·25	9·22
,, ...	25·1	29·39	17·19	15·85	9·00
H_2SeO_3	25·2	26·84	15·78	15·95	9·12
,, ...	26·1	26·98	15·85	16·09	9·19
KSeCN	25·0	42·31	25·23	25·79	15·50
,, ...	22·1	41·83	24·77	25·30	15·04

constants of a number of selenium compounds for the rays H_α, H_β, H_γ, and D; the results for the D line are summarised in the table on p. 249.

Ethylic selenide, ethylic biselenide, and selenoxene were examined in the pure liquid state; the two determinations quoted for selenic acid were made in 41·8 and 27·3 per cent. aqueous solutions, and those for selenious acid in 30·6 and 23 per cent. solutions. Potassium selenocyanate was examined in 32·8 and 43·5 per cent. aqueous solutions. The values for selenoxen are calculated on the supposition that this substance has the constitution



$$\left.\begin{array}{l}CH{:}CMe\\ |\\ CH{:}CMe\end{array}\right>Se.$$

The author concludes that selenium in combination behaves very similarly to sulphur in respect to its refraction constants; the diversity in behaviour of selenium in its various compounds is, however, much less strongly marked than is that of sulphur. It is to be expected that tellurium would behave even more uniformly than selenium; experiments in this direction are now in progress.

W. J. P.

Spectrochemistry of Nitrogen. By JULIUS W. BRÜHL (*Zeit. physikal. Chem.*, 1895, **16**, 497—511 and 512—524; compare this vol., ii, 194).—The author examines the previously determined refraction constants of the various groups of nitrogen compounds; the first paper deals with the amines, and the atomic refraction and dispersion of the nitrogen are calculated in the usual manner. For the primary amines (nine examined), including ethylenediamine and its hydrate, the mean values for the atomic refraction and dispersion are respectively 2·311 and 0·074, the separate numbers being in close concordance (2·45—2·16 and 0·06—0·08). The agreement of the values for the nitrogen in the ethylenediamine hydrate with the remainder indicates, the author considers, that this is a molecular compound $C_2H_4(NH_2)_2 + OH_2$. This mean value is practically identical with the values in ammonia and hydroxylamine. Benzylamine and *ac*-tetrahydro-β-naphthylamine give the same numbers, but in those compounds where the nitrogen is directly united to the aromatic ring (eight examined) higher values obtain, $r_\alpha = 3·016$, $r_\gamma - r_\alpha = 0·624$. The secondary amines (10) both in the fatty series and the piperidines give the mean values, $r_\alpha = 2·604$ and $r_\gamma - r_\alpha = 0·135$, but where the nitrogen is combined with a benzene group, higher values obtain, namely, 3·408 and 0·815. In the case of tertiary amines (seven), the constants become 2·924 and 0·191, the individual numbers agreeing satisfactorily with the mean. In the aromatic tertiary amines (five), the numbers increase to 4·105 and 1·105. The atomic constants for carbon and hydrogen are also obtained by comparing compounds of the same class differing only by a number of carbon or of hydrogen atoms. The results give 2·347 and 0·07 for carbon (previous values 2·365 and 0·039) and 1·071 and 0·023 for hydrogen (previous values 1·103 and 0·036). In the dichloramines, as would be expected, the values for the nitrogen rise, 3·53 and 0·25.

The second paper deals with constants in the cyanides and the oximes. In the fatty cyanides and dicyanides (nine), the mean atomic values for the nitrogen are found to be 3·176 and 0·084. Cyanogen, however, gives the values 3·77 and 0·25, and the aromatic cyanides 3·825 and 0·450. It is noticeable that in all these compounds the atomic refraction for the sodium light is less than that for the red α line. Hydrogen cyanide gives a value (for sodium light) closely agreeing with aliphatic cyanides, and hence its constitution is most probably $\mathrm{H{\cdot}C{:}N}$. The oximes of the aliphatic series give the mean values 3·921 and 0·251, numbers which are greater than those of the triply linked nitrogen. As in the amines and other series, the numbers are increased by the substitution of an aromatic group for a fatty group, the aromatic oximes yielding numbers varying from 4·66 to 5·86 for r_α and 0·35 to 1·26 for $r_\gamma - r_\alpha$. These numbers may be tabulated thus

	r_α.	$r_\gamma - r_\alpha$.
$\mathrm{H_2N^{-C-}}$	2·31	0·07
$\mathrm{HN^{(-C-)_2}}$..........	2·60	0·14
$\mathrm{N^{(-C-)_3}}$..........	2·92	0·19
$\mathrm{H_2N^{(-Bz)}}$	3·02	0·62
$\mathrm{H\overset{Bz}{N}{}^{-C-}}$...........	3·41	0·82
$\mathrm{\overset{Bz}{N}{}^{(-C-)_2}}$..........	4·11	1·11
$\mathrm{\overset{Bz_2}{N}{}^{(-C-)}}$..........	4·52	—
$\mathrm{O{-}N{=}C}$............	3·92	0·25
$\mathrm{N{\equiv}C}$............	3·18	0·08

L. M. J.

Optical Rotation of Ethereal Salts of Malic acid. By Richard Anschütz and Hans Reitter (*Zeit. physikal. Chem.*, 1895, **16**, 493—496).—The authors have determined, at a temperature of 20°, the rotatory power of some ethereal salts of lævo-malic and acetylmalic acids, employing for the purpose a Wild's polaristrobometer. The following results were obtained.

Compound.	d 20°/4°.	a°.	$\mathrm{M_{[D]}}$.
Methylic malate	1·2334	− 8·449	−11·150
Ethylic malate...............	1·1280	−12·007	−20·226
n-Propylic malate	1·0736	−12·455	−25·290
n-Butylic malate	1·0382	−11·132	−26·376
Methylic acetylmalate	1·1983	−27·398	−46·64
Ethylic acetylmalate	1·1169	−25·244	−52·43
n-Propylic acetylmalate	1·0729	−24·318	−58·96
n-Butylic acetylmalate	1·0430	−20·782	−57·38

L. M. J.

Gas Batteries. A Correction. By Fred. J. Smale (*Zeit. physikal. Chem.*, 1895, **16**, 562—564).—The author makes a correction to be applied to a part of the theoretical portion of his paper on gas batteries (Abstr., 1894, ii, 436), by which it appears that although for a HO-chain the electromotive force is practically independent of the nature and concentration of the electrolyte, yet if, instead of oxygen, other gases, such as chlorine, &c., are employed, the electromotive force varies more or less with the concentration, a result in accord with the experimental determinations. L. M. J.

Electrical Conductivity. By KARL STRECKER (*Ann. Phys. Chem.*, 1895, [2], **54**, 434—441).—Although a current passing through an electrolyte deflects a magnet and heats the conductor in accordance with the same laws that hold for metallic conductors, different views are taken of the mechanism of the process in the two cases. In a metallic conductor, the electrical disturbance is regarded as taking place in the surrounding ether, a molecular, non-electrical disturbance occurring in the conductor itself; in electrolytes, the electrical energy is transported by the smallest particles of the mass, the ions, the ether not being concerned in the change. The author regards these views as contradictory, and in the case of electrolytes suggests that, as in metallic conductors, the ether is still the seat of the electrical disturbance. The ions transform electrical into kinetic energy, which on the liberation of the ions at the electrodes becomes potential chemical energy. H. C.

Electrical Conductivity and Convection in Dilute Solutions of Small Conductivity. By EMIL WARBURG (*Ann. Phys. Chem.*, 1895, [2], **54**, 396—433).—Liquids of low conductivity such as benzene, xylene, and turpentine do not seem to follow Ohm's law, but under the continued influence of a high E.M.F. show a gradual alteration in conductivity. Such substances also exhibit the phenomenon of electrical convection, a current of the electrolyte setting in from the one electrode while the other electrode appears to simply attract the repelled liquid. The author has studied these changes, making use of mixtures of substances of low conductivity and gradually reducing the proportion of one of the constituents until the conductivity was nearly that of the other. Such solutions as these still exhibit the phenomena referred to, and it was found that their behaviour is in keeping with the view that they contain an electrolyte present in very dilute condition, their conductivity depending on the presence of this electrolyte. The behaviour of the so-called pure liquids is probably capable of similar explanation.

H. C.

Electrical Conductivity in Aqueous Solutions. By EMIL FRANKE (*Zeit. physikal. Chem.*, 1895, **16**, 463—492).—The first portion of the paper deals with experiments on the conductivity of aqueous solutions of salts of thallium, lead, nickel, cobalt, and copper, and various salts of permanganic acid. From the results, it appears that with monobasic acids the thallium salts are dissociated to about the same extent as the alkali salts. With dibasic acids in the more concentrated solutions they are, however, more feebly dissociated than salts of the alkali metals, so that thallium takes an intermediate position between these and the series of divalent metals, cobalt, &c., whose salts with monobasic acids obey the valency rule, but whose sulphates, &c., depart from it. From the experiments with permanganates, the acid appears to be a strong monobasic acid of acidity equal to nitric acid, but unstable and easily decomposed, as evidenced by the rapid fall in its conductivity.

The second portion of the paper contains experiments on the affinity constants of the saturated fatty acids. A table of the anion velocities is first calculated, the values decreasing from 51·4 in the case of formic acid to 26·0 in the case of pelargonic acid, and agreeing well with the general law of Bredig (Abstr., 1894, ii, 227). The affinity constants of the acids considered are contained in the following table.

Acid.	K (= 100 *k*).	Acid.	K (= 100 *k*).
Formic	0·0214	Capric	0·00138
Acetic	0·00180	Isobutylacetic	0·00145
Propionic	0·00134	Diethylacetic	0·00189
Butyric	0·00152	Heptoic	0·00131
Isobutyric	0·00143	Caprylic	(0·00144)
Valeric	0·00150	Pelargonic	(0·00112)
Isovaleric	0·00167		

The affinity constants also determined for series of isomeric derivatives of hippuric acid and the heats of combustion (observed by Stohmann) are also added, the relative order of this constant for the isomerides agreeing with that of the conductivity. L. M. J.

Radiation at Low Temperatures. By Raoul Pictet (*Zeit. physikal. Chem.*, 1895, **16**, 417—449).—In the first experiments recorded, five calorimeters were cooled to a temperature of about −165°, and allowed to regain the ordinary temperature. Of these one was unprotected, and the other four had coverings of cotton-wool of various thicknesses. The curve of heating was thus obtained for each vessel, constructed with time abscissæ, and as ordinates, the rate of flow of heat per unit of superficial area. From −165° to −100° all the curves lie close together and are practically coincident; from −100° to −70° they begin to widen, but the protective influence of the cotton-wool is not yet at all proportionate to its thickness. All show that at these low temperatures the gain of heat is much greater than that corresponding with the Newtonian curve which is obtained by extrapolation from the results above 0°. At about −80° the curves bend more or less sharply and resemble in form the Newtonian curve, while in their concluding portion −20° to +10° protective influence of the cotton-wool appears more and more proportional to its thickness. At −165° to −70°, moreover, no difference is noticed if the cotton-wool is replaced by cork, wood, glass, sand, &c. The author next describes some noteworthy anomalies in the crystallisation of chloroform, which in the smaller of two refrigerators crystallised at from −68·5° to −69·5°, but in the larger remained liquid at −81°. The author considers that the ordinary non-conducting materials have for heat at very low temperatures very different diathermancy from that which they possess for ordinary heat rays, being almost perfectly transparent in the former case, and this conclusion explains the recorded observations. The physiological effects of low temperatures were studied by placing (1) a dog, and (2) the author himself in the refrigerater, the head being kept outside in both cases. The author states that he felt no cold but an indescribable tickling sensation in both the exterior and interior of the body. The pulse rose to 67 and the respiration to 19 per minute, while a most marked sensation of hunger was experienced. After leaving the refrigerator a very sharp "pins and needles" sensation lasted for about a quarter of an hour, and he states that for the first time in six years he was able to enjoy food. He has since repeated the experiments many times with precisely the same effects, the low temperature being, he considers, beneficial as a powerful digestive stimulant. L. M. J.

Correction of Thermochemical Measurements. By Adolfo Bartoli and Enrico Stracciati (*Gazzetta*, 1894, **24**, ii, 432—437).—The authors have calculated from their measurements of the specific heat of water (Abstr., 1893, ii, 443), a table serving for the correction of calorimetric determinations. W. J. P.

Acid Chlorides and Chloraldehydes. By Paul Rivals (*Compt. rend.*, 1895, **120**, 560—562).—The acid chlorides were decomposed by dilute aqueous potash, and the heat of decomposition by water was calculated from these results.

Chloracetic chloride, which is readily obtained in large quantity by the action of chlorine on acetic chloride in presence of iodine, gave the following results.

Heat of decomposition by water	+69·8 Cal.
C_2H_2ClOCl liq. + H_2 liq. = $C_2H_2ClO_2H$ sol. + HCl gas.........................	develops + 9·4 ,,
Heat of formation from elements.................	+24·25 ,,
C_2H_3OCl + Cl_2 = C_2H_2ClOCl liq. + HCl gas	develops +27·1 ,,

Trichloracetic chloride—

Heat of decomposition by water	+24·8 Cal.
C_2Cl_3OCl liq. + H_2O liq. = $C_2Cl_3O_2H$ sol. + HCl gas	develops + 4·5 ,,
Heat of formation from elements.................	+93·2 ,,
C_2H_3OCl liq. + $3Cl_2$ = C_2Cl_3OCl liq. + 3HCl gas	develops +31·5 × 3.

The heats of decomposition by water are not greatly different from those of acetic (+23·3), butyric (+21·7), and valeric (+20·17) chlorides, as determined by Berthelot and Louguinine, or malonic chloride (+22·1 × 2), as recently determined by Berthelot.

The heats of formation of acetic, chloracetic, and trichloracetic chloride increase somewhat regularly, and the heat of formation of dichloracetic chloride will be about 80 Cal. The substitution of one, two, and four atoms of chlorine for hydrogen in aldehyde, with formation of the acid chlorides, will develop +29·6, +28·35 × 2, and +31·3 × 4 Cal. respectively. The corresponding substitutions in acetic acid develop +28·2 Cal. for monochloracetic acid, and +30·3 × 3 Cal. for trichloracetic acid. The excessive thermal disturbance in the last case corresponds with the fact observed by Louguinine, that the heat of dissolution of trichloracetic acid is positive, whilst that of acetic and chloracetic acids is negative.

C. H. B.

Barium Nitride. By Marcellin Berthelot and Camille Matignon (*Bull. Soc. Chim.*, 1894, [3], **11**, 744).—The heat of dissolution of the anhydrous barium nitride is −7·8 Cal. Jn. W.

Calorimetric Behaviour of Saline Solutions; Sodium Acetate. By E. Monnet (*Compt. rend.*, 1895, **120**, 500—501).—Sodium acetate dissolves in water with absorption of heat, and the author has determined the variation in the heat of dissolution in the resulting solution by measuring the heat absorbed by the dissolution of varying weights of the salt in a constant weight of water. If S is the concentration of the solution, that is, the ratio of the weight of the hydrated salt to the weight of water added to it, and D*h* the heat absorbed in minor calories, the results are as follows.

S..........	0·04	0·08	0·12	0·16	0·20
D*h*	34·63	34·93	35·07	35·19	35·27

It is obvious that the heat of dissolution increases with the concentration of the solution, and consequently the dilution of a solution causes the liberation of heat. The determinations of the heat of dilution have been carried as far as a concentration of 28·5. At 15°, the curve obtained by taking the concentrations as abscissæ and the heats of dilution as ordinates is almost rectilinear between concentrations 0 and 10, and rises rapidly; there is a distinct curvature between concentrations 5 and 17·5, and above 17·5 the curve tends to become asymptotic to a right line parallel with the axis of the abscissæ of which the ordinate would be about 18. C. H. B.

Dissolution of Solids in Vapours. By P. Villard (*Compt. rend.*, 1895, **120**, 182—184).—The results obtained by Pictet (this vol., ii, 201) with an alcoholic solution of alizarin are similar to those previously obtained by the author with iodine and carbonic anhydride (*J. de Phys.*, 1894, [3], 3). If liquid carbonic anhydride is enclosed with a small quantity of iodine in sealed tubes, as the temperature rises the vapour above the liquid is colourless up to the critical point, when the violet tint is diffused throughout the tube. If, however, the iodine is placed at the top of the tube, the vapour above the liquid dissolves part of the iodine, and may acquire a colour deeper than that of the liquid. Until the critical point is reached, there is a neutral zone above the meniscus. At a low temperature, if the tube is agitated, the vapour is much less coloured than the liquid, but the difference disappears at the critical point. The solubility of the iodine in the liquid carbonic anhydride is very slight at −40°, but increases rapidly with the temperature. It is not, however, necessary that the vapour be saturated; a distinct coloration is observed at about 20—25° with gaseous carbonic anhydride compressed below its maximum tension.

In view of these facts, it seems unnecessary to assume that the solution of the solid is due to liquid vesicles suspended in the vapour (*loc. cit.*). The absorption spectrum of either the liquid or the vapour shows none of the channelled spaces characteristic of gaseous iodine, and hence it would seem that the iodine is truly in solution in the vapour, even when the latter is not saturated. C. H. B.

Application of the Schroeder-Le Chatelier Law of Solubility to Solutions of Salts in Organic Liquids.

By C. E. LINEBARGER (*Amer. J. Sci.*, 1895, **49**, 48—53).—Schroeder and Le Chatelier have independently shown that the solubility of a substance may be calculated by means of the relationship

$$\log_e s = \frac{\rho}{2}\frac{T_0 - T}{T_0 T},$$

in which s is the solubility, defined by the ratio of the number of the molecules of the dissolved substance to the total number of molecules making up the saturated solution, ρ the molecular latent heat of fusion of the dissolved substance, T_0 the absolute point of fusion of the dissolved substance, T the temperature at which saturation takes place. The author discusses data on the solubility of inorganic salts in normal organic liquids in the light of this law. The solubilities of mercuric and cupric chlorides in ethereal salts, of mercuric chloride, bromide, and iodide in carbon bisulphide, and of mercuric chloride, cadmium iodide, and silver nitrate in benzene are considered. No trace of the applicability of the law is found in these cases. H. C.

New Application of the Principle of the Reduction of Solubility to the Determination of Molecular Weights.

By ST. TOLLOCZKO (*Ber.*, 1895, **28**, 804—809).—Nernst (Abstr., 1890, 1369) has shown that the relative decrease in solubility towards some second liquid which a solvent undergoes, owing to the addition of some foreign substance, is as the number of molecules of the dissolved foreign substance to the number of molecules of the solvent. As no simple application of this principle has yet been devised, the author proposes the determination of the decrease in solubility by the volumetric method. The only apparatus required for the purpose is a flask with a long, thin, calibrated neck. The liquids most suitable for general use are water and ether, and a mixture of these is placed in the flask, the solutions being so adjusted that the boundary between them lies in the neck of the flask. The foreign substance, the addition of which alters the solubility of the ether in the water, is now added, and, when equilibrium is again established, the boundary will be found in some new position in the neck of the flask, the displacement being proportional to the decrease in solubility.

If L_0 is the solubility of pure ether in water, and L the solubility after the addition of g grams of foreign substance of molecular weight M,

$$\frac{L_0 - L}{g} M = C.$$

C is a constant, and obviously represents the decrease in the solubility of ether in water on the addition of 1 gram-molecule of the foreign substance. C will vary with the apparatus used, and also with the relative amount of ether used in the experiment, but may be determined once for all for any given apparatus and quantity of ether by making a determination with a substance of known molecular weight, such as naphthalene. Great care must be taken to keep the temperature as constant as possible while carrying out a determination, if possible within $\frac{1}{10}$°. The author's test experiments gave satisfactory results. H. C.

Isomorphous Mixtures. By Fritz W. Küster (*Zeit. physikal. Chem.*, 1895, **16**, 525—528).—Ambronn and Le Blanc have objected to the term isomorphous "mischungen," inasmuch as by this word is usually understood a molecular interpenetration, and considers the term isomorphous "gemenge" more applicable; with this objection the author does not agree. L. M. J.

Atomic Weights. By Paul E. Lecoq de Boisbaudran (*Compt. rend.*, 1895, **120**, 361—362).—The same considerations that enabled the author to predict with some accuracy the atomic weight of gallium, and to correct that of germanium, lead to the conclusion that there is a family of elements, of which argon seems to be the first known member. The elements in this group will be of a non-metallic character, and will have the atomic weights 20·0945, 36·40 ± 0·08, 84·01 ± 0·20, and 132·71 ± 0·15, if O = 16. Theoretically, they should be octovalent, but they will have little tendency to enter into combination at all. The elements with atomic weights 20·0945 and 36·40 should be relatively abundant, but the other two, and especially the last, will be rare. The element 36·40 should be more volatile than sulphur, and the element 20·0945 more volatile than oxygen, whilst 84·01 and 132·71 should be more volatile than selenium and tellurium respectively.

The author agrees with Ramsay and Rayleigh in placing argon in Mendeléeff's eighth group, to which all the four elements referred to above probably belong. C. H. B.

Velocity of the Reaction between Ferric and Stannous Chlorides. By Arthur A. Noyes (*Zeit. physikal. Chem.*, 1895, **16**, 546—561).—The equation representing the action between ferric and stannous chlorides is of the third order, not of the second order, as stated by Kahlenberg (Abstr., 1894, ii, 346), *i.e.*, is $2FeCl_3 + SnCl_2 = 2FeCl_2 + SnCl_4$; hence the velocity should be given by the equation $dx/dt = c_3(A-x)(B-x)^2$. The experimental proof of this is obtained in the far greater constancy of the constant derived from this equation than of that calculated on the assumption that the action is of the second order, and also by the fact that excess of ferric chloride caused a much greater alteration of the velocity than an equivalent excess of stannous chloride. In neutral solutions, also, Kahlenberg's own numbers give a more constant value for the third order constant than for that from the second order reaction. If acid be added, the values for c_3 do not show such satisfactory constancy, and the action apparently approximates to the second order, but the author is unable to satisfactorily determine the exact nature of the *rôle* played by the acid. L. M. J.

Velocity of Etherification of Methylic Alcohol. By EMIL PETERSEN (*Zeit. physikal. Chem.*, 1895, **16**, 385—410).—The velocity of etherification in alcoholic solutions was determined by two methods—(1) a direct method; (2) an indirect method, in which a small quantity of methylic chloride is added to the reacting liquids. In the first case, the velocity is obtained by the equation $dx/dt = k(P - x)(Q - x) - k'x^2$, where P and Q are the initial concentrations. If the ratio $k'/k = \frac{1}{4}$, as in very many cases, this expression is reducible after integration to the form $K = \frac{1}{t} \log \frac{P - x/a}{P - x/b}$. When the indirect method is employed, the expression becomes $K = \frac{1}{Qt} \log \frac{P}{P - x}$, where Q is the initial concentration of the methylic chloride, and P that of the acid. The experiments were performed at the temperatures of 100° and 66°, jackets of steam or methylic alcohol vapour being employed. Formic, acetic, glycollic, oxalic, malonic, succinic, malic, tartaric, racemic, and citric acids were examined by the direct method, but the results were not in all cases trustworthy. The results of the experiments performed by the indirect method are given in the accompanying table of the values of K. It is noticeable that the ratios of the velocity at 100° to that at 66° vary only between about 2·5 and 3·0, and the author hence concludes that the alteration is due chiefly to change in the molecular properties of the methylic alcohol.

Acid.	T = 100°.		T = 66°.	
	V = 5.	V = 10.	V = 5.	V = 10.
Acetic	23·3	26·5	9·0	8·9
Propionic	18·7	21·6	6·7	7·7
Butyric	11·7	11·6	4·5	4·2
Isobutyric	7·7	9·6	3·1	3·4
Valeric	3·6	4·2	1·2	1·4
Benzoic	0·30	0·28	—	—
Paratoluic	0·25	0·25	—	—
Orthotoluic	0·095	0·075	—	—
Salicylic	0·016	0·015	—	—

L. M. J.

Relative Affinities of Organic Bases in Alcoholic Solution. By ZDENKO H. SKRAUP (*Monatsh.*, 1894, **15**, 775—786).—In order to check the results obtained by observation of the specific conductivity in aqueous solution, the author has taken advantage of the known fact that optically active bases in alcoholic solution frequently show a different specific rotatory power from that of their salts. By ascertaining the change in specific rotatory power which occurs when an optically inactive base is added to a salt, say the hydriodide of an optically active base in alcoholic solution, it becomes possible to determine the relative affinities of the bases. Working on such lines, the values 1, 1·4, 3, 5, and 21 were obtained for cinchonidine, trimethylamine, benzylamine, ammonia, and methylamine respectively. These numbers are somewhat different from those obtained by Bredig, who, from their behaviour in aqueous solution, gives the values 0·0074, 0·0025, 0·0023, and 0·050 for trimethylamine, benzylamine, ammonia, and methylamine respectively. G. T. M.

The Formation of Oximes. By UGO PRATI (*Gazzetta*, 1894, **24**, ii, 310—316).—The action between acetone and hydroxylamine hydrochloride, $COMe_2 + NH_2{\cdot}OH,HCl = CMe_2{:}NOH + HCl + H_2O$, is a reversible one, so that at a certain time after the commencement of action between molecular proportions of these substances a state of equilibrium is attained. If K be the velocity of the above reaction, and K_1 that of the reverse change, the course of the action should be represented by a differential equation of the form

$$dx/dt = K(A - X) - K_1X^2;$$

on determining the ratio K_1/K after equilibrium has become established, this equation can be integrated and the values of x calculated. Experiments made with solutions of various concentrations at 10° show that the above expression closely represents the course of the reaction; equilibrium becomes established when about one-third of the acetone present is converted into the oxime.

If the action proceeds in presence of sufficient alkali to neutralise the whole of the hydrochloric acid liberated, its course should be represented by an equation of the form $dx/dt = K(A - X)^2$, which on integration gives the constant $K = X/At(A - X)$. Experiments made in presence of baryta show that, owing to secondary actions, K is not constant, but diminishes continuously as the time increases.

The author further gives the results of a preliminary investigation of the action occurring between hydroxylamine hydrochloride and acetylacetone. W. J. P.

Theory of Dyeing. By GEORG V. GEORGIEVICS (*Monatsh.*, 1894, **15**, 705—717).—The author has more closely examined the process of dyeing silk with indigo-carmine, and finds that the sulphuric acid added to the dye-bath has a twofold function. It liberates the acid dye, and further, when employed in excess, plays the same part as the salt added during the dyeing of cotton with benzidine dyes. In the case of the process under investigation, the coefficient of distribution, $\frac{\text{dye taken up by fibre}}{\text{dye remaining in bath}}$, is not a constant, but gradually decreases with an increasing concentration of the dye-bath. The expression $\frac{\sqrt{\text{dye remaining in bath}}}{\text{dye taken up by fibre}}$, on the other hand, is a constant, and it would therefore appear that simple colour molecules are fixed on the silk, although the dye exists in the bath chiefly in the form of complex double molecules. Henry's law, extended by van't Hoff and Nernst, appears to hold perfectly good in dyeing silk a light indigo-carmine. The value of the coefficient of distribution is greatest for the so-called basic dyes, and least for those resembling salts, whilst for acid dyes it occupies an intermediate position. The value $\frac{\sqrt[x]{\text{dye remaining in bath}}}{\text{dye taken up by fibre}}$ is a constant for most, if not for all, substantive colours, where x expresses the measure of the affinity of the dye for the fibre. The influence of the sulphuric acid on the absorption of the acid dyes by the fibre, and the law which holds for the dyeing of silk with indigo-carmine, point clearly against the assumption that a chemical change occurs between the dye and the fibre, and favour the author's opinion that the dyeing of silk with indigo-carmine is a phenomenon analogous to that of solution. G. T. M.

Apparatus for Reflux or Distillation. By CARL MANGOLD (*Zeit. angw. Chem.*, 1895, 159).—Into the distillation flask is fitted a tube, A, to which, at a short distance from the top, and opposite to one another, are attached two tubes; one of these is bent upwards and connected with a reflux condenser, whilst the other is attached to a Liebig's condenser, with a cork cut obliquely at the lower end fitted into the top of the tube A; by turning the cork round the vapours may be directed at will into either condenser. L. DE K.

New Muffle. By ÉMILE AUBIN (*Bull. Soc. Chim.*, 1894, [3], **11**, 596—597).—An additional muffle is placed over, but in the same chamber as, an ordinary muffle, so that it is heated by the waste products from the burners below. It is useful for preliminary incinerations in agricultural analysis, &c., the temperature being such as to readily carbonise the organic matter without risk of fusing the ash. The incineration of the imperfect ash thus obtained is then easily completed at the higher temperature of the lower muffle. The consumption of gas is not greater than in the ordinary form. JN. W.

Lecture Experiments. By JAKOB VOLHARD (*Annalen*, 1895, **284**, 345—349).—In demonstrating the increase of weight incurred by air acting as a supporter of combustion, it is necessary that the heated charcoal over which the air is led should be in large fragments, otherwise carbon is locally in excess, and the tared balloon becomes filled with the monoxide.

A simple contrivance is described for illustrating by burning sulphur the increase in weight which oxygen undergoes. A stoppered flask of more than 1 litre capacity is filled with oxygen and weighed. In another stopper exactly fitting this flask are inserted a deflagrating spoon and a mercury manometer. One gram of sulphur is placed in the spoon and ignited, the second stopper being then substituted for the one in the flask, and when the product of combustion has cooled sufficiently to exert only atmospheric pressure, the first stopper is replaced, and the flask is weighed. The sulphurous anhydride may be dissolved in water and added to a strong boiling solution of phosphorous acid in order to demonstrate the presence of sulphur in the gas. M. O. F.

Inorganic Chemistry.

Atomic Weight of Oxygen. By EDWARD W. MORLEY (*Amer. Chem. J.*, 1895, **17**, 267—275).—The experiments described in this paper consist of 12 syntheses of weighed quantities of water from weighed quantities of hydrogen and of oxygen. The hydrogen was absorbed in 600 grams of palladium; the oxygen was weighed in two globes. The apparatus in which the water was synthesised and weighed consisted of a thin glass tube 22 cm. by 25 mm. Midway in its length were inserted two tubes, ending within in two platinum jets parallel to the axis of the long tube. The gases passed into the jets through drying tubes filled with phosphoric anhydride, and were ignited by means of sparks passed between platinum wires fused into the tube just above the jets.

These and other experiments will be more fully described in a memoir to be published by the Smithsonian Institution. The results of the present paper may be summarised as follows.

Density of oxygen, latitude 45°	1·42895	± 0·000034
" hydrogen	0·08987	± 0·0000027
Ratio of densities	15·9002	± 0·00061
Vol. composition of water at 0° . ..	2·0027	± 0·00014
Atomic ratio from densities and volumetric ratio....................	15·879	± 0·0011
Atomic ratio, syntheses............	15·8792	± 0·00032
Mol. weight of water, syntheses	17·8785	± 0·00066

J. J. S.

Solubility of Sulphur Precipitatum in Carbon Bisulphide. By EMIL TITTINGER (*Chem. Centr.*, 1894, ii, 267; from *Pharm. Post.*, **27**, 297).—The author finds that neither ordinary stick sulphur nor flowers of sulphur is completely soluble in carbon bisulphide. Precipitated sulphur, however, prepared according to the Austrian pharmacopœia, is completely soluble in 5 parts of cold carbon bisulphide. Sulphur precipitated from a calcium hyposulphite solution by hydrochloric acid is also soluble if the solution be maintained slightly alkaline, but if the solution is rendered acid, the precipitated sulphur is only partially soluble. E. C. R.

Hydrate of Nitric acid, $HNO_3,7H_2O$: Action of Nitric acid on Organic Compounds. By Victor H. Veley (*Ber.*, 1895, **28**, 928—931).—From a consideration of certain physical and chemical properties of aqueous nitric acid, it appears that these undergo decided modification at a stage of dilution at which the composition of the acid (33 per cent.) corresponds with that of a heptahydrate. The electrical conductivity attains a maximum at 30—37 per cent.; the rate of variation of the magnetic rotation changes abruptly at 33 per cent.; and, as the author has previously observed, certain metals (mercury, copper, bismuth) which cannot be made to dissolve in dilute nitric acid when an oxidising agent is present to prevent the formation of nitrous acid, cannot be prevented from doing so when the strength of the acid exceeds 33 per cent. (Silver, however, is an exception to this rule, as silver-foil is not appreciably attacked, even by 37 per cent. acid, in presence of hydrogen peroxide.) The action between nitric oxide and nitric acid, too, is only strictly reversible with concentrations between 30 and 32 per cent.

The author's hypothesis, that the nitration of hydrocarbons is brought about in the first instance by nitrous acid, is confirmed by Cross's observation that jute is converted into a nitroso-derivative by nitric acid containing nitrous acid, but is merely hydrolysed by pure nitric acid; and by those of Behrend and his collaborators, who have shown that dilute nitric acid (1 : 4) acts on acetone only in the presence of nitrous acid, and that the initial products are isonitrosoacetone and acetylnitrolic acid. Denninger's observation, that certain hydroxybenzoic acids can be nitrated by nitrous acid alone, may be explained by assuming that nitroso-compounds are formed in the first instance, and are then either decomposed by nitric acid or oxidised by nitric oxide, arising in either case from decomposition of the nitrous acid.

The action of metals on nitric acid is probably analogous, a nitrite being formed in the first instance and decomposed by the nitric acid.

Jn. W.

Products formed by the Slow Oxidation of Phosphorus. By Jacobus H. van't Hoff (*Zeit. physikal. Chem.*, 1895, **16**, 411—416).—The author draws attention to Ewan's results, proving that the velocity of oxidation of phosphorus is proportional to the square root of the oxygen pressure (this vol., ii, 213), and may hence be due to oxygen atoms or to oxygen ions, and points out further that the activity of the oxygen caused by the slow oxidation of phosphorus may also be due to oxygen ions and not to ozone. A series of experiments were performed to determine the quantity of oxygen rendered active, the results indicating that the amount is a half atom of oxygen per atom of phosphorus, this amount being independent of the nature of the acid of phosphorus produced. Hence, he considers that the activity is *not* due to ozone, and that this is not formed, at least in the first instance, during the slow oxidation of phosphorus. L. M. J.

Amorphous Silicon. By Vigouroux (*Compt. rend.*, 1895, **120**, 367—370).—The silicon obtained by reduction with magnesium (this vol., ii, 222) is a light maroon-coloured powder of sp. gr. 2·35 at 15°; it readily absorbs gases and water vapour, which can only be expelled at a red heat. It is readily fused and volatilised in the electric furnace, and dissolves in many molten metals.

Amorphous silicon is not affected by heat alone or by hydrogen when heated in it, but fluorine attacks it with incandescence at the ordinary temperature, chlorine at 450°, and bromine at about 500°; whilst iodine has no action, even at high temperatures. When heated in air, the silicon oxidises superficially only, but in oxygen at about 400° it burns vividly, and the temperature is high enough to fuse the silica that is formed. In sulphur vapour, it becomes incandescent at about 600°; nitrogen has no action below 1000°, but at this temperature an amorphous nitride is formed; phosphorus, arsenic, and antimony vapours have no action, and carbon and boron combine with the silicon only in the electric furnace.

Dry gaseous halogen hydracids slowly attack the silicon at a dull red heat; hydrogen sulphide has no action; ammonia is decomposed at a cherry-red heat with formation of silicon nitride and liberation of hydrogen. Water vapour is slowly but continuously decomposed at about the same temperature with formation of silica; sulphurous anhydride has no action, even at 1000°; nitrous and nitric oxides act slowly at 800°, sometimes with incandescence, the silicon combining with both nitrogen and oxygen; phosphoric anhydride and the oxides of arsenic and antimony are reduced below a red heat with incandescence; carbonic anhydride is converted into carbonic oxide between 800° and 1000°, but the latter is not attacked even at 1200°.

No single acid attacks the silicon, and this is true of boiling fuming nitric acid, boiling concentrated sulphuric acid, and even concentrated hydrofluoric acid at 100°.

With two acids or an acid and another substance, however, the silicon is often attacked; for example, at the ordinary temperature by a mixture of nitric and hydrofluoric acid with evolution of nitrogen oxides and silicon fluoride, or slowly at 100° by aqua regia. A mixture of hydrofluoric acid with potassium nitrate or chlorate, or of nitric acid and potassium fluoride, produces a violent action, but with nitric acid and potassium chlorate there is no change.

Silicon reduces silver, zinc, and lead fluorides with incandescence below a red heat, and many metallic oxides are reduced with incandescence at the temperature of the Bunsen burner, and the hydroxides of the potassium and calcium groups are readily decomposed. Potassium hydrogen fluoride acts on the silicon with evolution of hydrogen; lead sulphate and calcium phosphate are reduced by it. Potassium chlorate has no action at the temperature of its decomposition, but if the two substances are intimately mixed and rapidly heated, oxidation takes place; potassium nitrate attacks the silicon only at its temperature of decomposition; alkali carbonates, either fused or in solution, convert it into silica; potassium dichromate, lead chromate, and similar oxidising agents, oxidise it explosively below a red heat.

The amorphous silicon obtained by reduction with magnesium differs in its properties from the α-silicon and β-silicon of Berzelius, and resembles rather crystallised silicon. The latter has hitherto been regarded as non-combustible, but, if rapidly heated in oxygen, it takes fire at about 400°, and burns with intense brilliancy.

C. H. B.

Analysis of Silicon. By VIGOUROUX (*Compt. rend.*, 1895, **120**, 554—557).—Silica is estimated by heating the silicon in dry chlorine at about 450°, and afterwards at a higher temperature to ensure decomposition of the silicides. The residue is allowed to cool in hydrogen, and is then weighed. Foreign substances other than silica are left undissolved when the finely-powdered silicon is boiled with a solution of potassium carbonate; the solution contains silica originally present as impurity, and that formed by the action of the alkali on the silicon. Metallic impurities are obtained as sulphates by adding to the silicon a mixture of nitric and hydrofluoric acids free from chlorine, and then concentrated sulphuric acid, drop by drop, until the temperature rises sufficiently high for the commencement of the action on the silicon.

Silicon from quartz and commercial magnesium contained silicon 89·27, silica 3·01, iron and aluminium silicides 7·62, after one treatment with hydrofluoric and nitric acids, and silicon 97·02, silica 0·66, and silicides 2·34, after three treatments.

With purified silica and distilled magnesium the product contained silicon 99·09—99·60, silica 0·68—0·20, other impurities 0·23—0·20, = 100·00.

Silicon, obtained by Berzelius' method, contained from 22·81 to 54·21 per cent., according to the mode of manipulation, the impurities resulting to a large extent from the action of the excess of potassium on the primary products. The process given by Berzelius for the preparation of β-silicon yields a product containing very little silicon. Crystallised silicon, prepared without special precautions, contains about 5 per cent. of impurities, consisting chiefly of metallic silicides, which can be removed by heating in a current of air and afterwards treating with hydrofluoric acid. C. H. B.

Action of Water on Coal. By GEORGES ARTH (*Bull. Soc. Chim.*, 1894, [3], **11**, 619—622).—Powdered coal of various kinds, containing from 1·6 to 8·3 per cent. of oxygen, was subjected to the prolonged action of air, and of stagnant and running water, with the result that neither the composition, nor the yield of coke, nor the calorific power were appreciably affected. JN. W.

Haloïd Salts of Cæsium. By NICOLAI N. BÉKÉTOFF (*Chem. Centr.*, 1894, ii, 229; from *Bull. Acad. St. Petersburg*, [4], **2**, 197—199).—The heat of formation of cæsium iodide from cæsium and iodine in solution is 78,400 cal., and the heat of solution of the salt is −8164 cal., which gives as the heat of formation of the solid salt 86,564 cal. A number which is higher than the heat of formation of potassium iodide, namely, 80,130 cal. The molecular volume of cæsium iodide is 57·5. The atomic volume of cæsium is 70·7, that of iodine 25·6, and the sum of the two 96·3. From these data, the volume contraction which takes place during combination is 40·3 per cent., that is more than in the case of the formation of potassium iodide, which is 22 per cent. This difference, however, is not accounted for by the greater heat of formation of cæsium iodide, but, according to the author, is also due to the ratio of the atomic weights of the components; which is another fact in support of the author's views as to the influence of atomic weight on chemical energy. The heat of formation of cæsium bromide is 99,800 cal., which is again higher than the number for potassium bromide, namely, 95,300 cal. E. C. R.

Action of Hydrogen on Cæsium Oxide. By NICOLAI N. BÉKÉTOFF (*Chem. Centr.*, 1894, ii, 229—230; from *Bull. Acad. St. Petersburg*, [4], **2**, 247—249).—The author has already shown that the anhydrous oxides of the alkali metals are reduced by hydrogen, whereby one half of the metal is set free and the other half is converted into hydroxide. This action, according to the author's views, is dependent on the ratio of the atomic weight of the metal to the equivalent weight of oxygen, and takes place more easily the higher the atomic weight of the metal. Thus of all the alkali oxides, lithium oxide is the only one which is not reduced by hydrogen. In the case of cæsium oxide, on the contrary, the reduction takes place easily at the ordinary temperature. E. C. R.

Action of Hydrogen on Photographic Dry Plates. By ERNST COHEN (*Zeit. physikal. Chem.*, 1895, **16**, 450—452).—Ordinary silver bromide gelatin plates were soaked in a dilute solution of soda, mixed in some experiments with a solution of platinic chloride. They were then exposed in the dark to the action of a current of hydrogen. After from 15 to 20 hours, the plates were completely blackened by a deposit of silver. The reduction does not occur if the platinum salt is absent, although a small trace is sufficient to cause blackening. The action is hence probably due to the reduction of the platinum salt in the first instance, the reduced metal then reacting with the silver bromide. L. M. J.

Properties of Calcium Carbide. By FRANK P. VENABLE and THOMAS CLARKE (*J. Amer. Chem. Soc.*, 1895, **17**, 306—310).—The calcium carbide used in the author's experiments was prepared by the Willson Aluminium Company.

Action of Water.—One gram of the substance will yield an average of 200 c.c. of gas, which the authors have proved to be practically pure acetylene. On account of the cheapness of the raw materials it ought to make a valuable addition to the illuminating agents.

Action of Hydrogen.—This has no action in the cold. On igniting the carbide in a current of hydrogen for five hours, the only action seemed to be the formation of some tarry matter, which partly condensed in the cold part of the tube.

Action of Air and Oxygen.—Ignition in a current of air causes the same tarry deposit, but the carbide is otherwise unaffected. Ignition in oxygen causes but a superficial oxidation.

Action of Hydrogen Chloride. This has no aotion in the cold, but at a red heat the carbide swells up and assumes a dirty white colour, and is to some extent transformed into calcium chloride.

Action of Chlorine and Bromine.—Chlorine had no action in the cold, but at a moderate heat a strong action was observed, and the fused mass consisted of calcium chloride. Bromine mixed with air had also no action in the cold, but, on heating, the mass glowed and fused, and was practically changed into bromide. Some gaseous matter, which partially condensed, was also formed. Chlorine water caused a violent evolution of gas which did not ignite spontaneously, but was inflammable, and burnt like acetylene. Bromine water behaved very similarly.

Action of Acids.—Scarcely any action was noticeable in the cold, but on heating a gas was given off which burned with a luminous flame. A mixture of the acid with potassium dichromate causes a very vigorous oxidation, but scarcely any inflammable gas. Strong nitric acid attacked the compound, with formation of brownish-red fumes, which also contained an inflammable gas. Glacial acetic acid slowly decomposed the carbide in the cold. Boiling sulphur did not act in the least, neither does carbonic acid.

Action of Alkalis.—The carbide, added to some fusing sodium hydroxide contained in a nickel dish, was violently attacked, with formation of acetylene. Sodium dioxide behaved similarly.

L. DE K.

Transformations of Zinc Sulphide. By A. VILLIERS (*Compt. rend.*, 1895, **120**, 149—151 and 188—190).—The rate of change of zinc sulphide from the protomorphic state (this vol., ii, 224), in which it is amorphous and soluble in solutions of alkali hydrosulphides, to the ordinary state, in which it is crystalline and insoluble, varies considerably with the temperature. When precipitated by hydrogen sulphide from a feebly alkaline solution of zinc oxide, the conversion into the insoluble form is rapid, although not instantaneous, between 70° and 100°, but is almost instantaneous at the latter temperature. A few degrees below 70°, the change does not begin for several minutes; at about 30°, half the sulphide remains soluble after three hours; between 20° and 15°, this stage is only reached after 17 hours; between 15° and 10°, there is no change even after two days; and between 10° and 0°, there is no change after ten days, even in presence of some added crystalline sulphide.

The conversion into the insoluble form takes place more slowly the more dilute the solution, provided that the quantity of alkali is as low as possible; in strongly alkaline solutions the diminution in the degree of alkalinity, consequent on dilution, compensates for the effect of dilution as such. The temperature of transformation rises as the degree of dilution increases, and also rises rapidly when the quantity of alkali present slightly increases. Dissolved salts, and notably ammonium salts and other alkali salts, have the same effect as concentration of the liquid, and greatly accelerate the change. If the amorphous precipitate is subjected to prolonged washing with hydrogen sulphide solution out of contact with air, it completely redissolves, although at a certain stage part of the sulphide has changed to the crystalline form.

C. H. B.

Crystallisation of Precipitates; Zinc and Manganese Sulphides and Cupric Hydroxide. By A. VILLIERS (*Compt. rend.*, 1895, **120**, 322—325).—If an alkaline solution containing the soluble amorphous form of zinc sulphide in suspension is frozen and kept at a low temperature for some hours, the sulphide is completely converted into the crystalline insoluble variety, although the temperature of conversion in the liquid is higher than 100°. Manganese sulphide in very dilute solution, with a very slight excess of hydrogen sulphide, behaves similarly, and is converted into the green sulphide as observed by Geuther 30 years ago, although the temperature of transformation in the liquid is above 300°. It seems probable that this effect is due to internal pressure in the freezing liquid.

Cupric hydroxide, precipitated from dilute solutions of the sulphate at a low temperature, washed at 0°, and suspended in water, is completely converted into the blue crystalline compound, CuO,CuH_2O_2, described by Peligot, if the liquid is frozen and kept at a low temperature for some hours. C. H. B.

Basic and Acidic Zinc Sulphide. By A. VILLIERS (*Compt. rend.*, 1895, **120**, 498—499).—The zinc sulphide precipitated by hydrogen sulphide from a slightly alkaline solution of sodium zinc oxide, or from the same solution after the addition of a slight excess of tartaric acid, is acidic in character, and dissolves in aqueous hydrogen sulphide even in complete absence of alkali. On the other hand, the sulphide precipitated from a solution of the sulphate is basic in character and quite insoluble in hydrogen sulphide. It is usually crystalline, although under certain conditions it can be obtained in an amorphous form. The varying function, sometimes acidic and sometimes basic, of the so-called indifferent oxides and sulphides, is probably due to a difference in molecular condition, more especially in the degree of condensation, analogous to that observed in the case of zinc sulphide.

C. H. B.

Action of the Spark Discharge on Lead Oxide. By EMIL WARBURG (*Ann. Phys. Chem.*, 1895, [2], **54**, 727—730).—The author has noticed that under the influence of the spark discharge, lead oxide darkens with formation of the peroxide when placed in a tube filled with oxygen under a pressure of 2 to 5 mm. In a tube of hydrogen at a pressure of 3 to 10 mm., darkening also takes place, probably with formation of metallic lead. In a nitrogen tube, no change occurs. Experiments with other metallic oxides also gave negative results.

H. C.

Action of Light on Lead Bromide. By R. S. NORRIS (*Amer. Chem. J.*, 1895, **17**, 189—191).—The darkening of lead bromide by light (Wells, *Amer. J. Sci.*, 1893, **45**, 134) is a much slower process than in the case of the silver salts, and is entirely superficial. A black specimen of the photo-product on being dissolved in water with the addition of a drop or two of nitric acid (dry lead bromide does not entirely dissolve in water), left about 1 per cent. of lead, and analysis showed a loss of 2—4 per cent. of the bromine. In a second experiment, in which a thin layer of the bromide was exposed to bright sunlight for two weeks, the product was lighter in colour than that which had been exposed for a shorter time and was entirely soluble in water acidified with nitric acid; the author suggests that the lead had oxidised during the long exposure. Carefully purified lead bromide was found to darken rapidly whether in the form of crystals or fused, and whether in an atmosphere of hydrogen or oxygen. The author regards the phenomenon as a simple dissociation.

A. G. B

Combination of Lead Iodide with Metallic Iodides and Organic Iodides. By A. MOSNIER (*Compt. rend.*, 1895, **120**, 444—446).—The iodide, $3PbI_2,4NH_4I + 6H_2O$, analogous to the lead potassium iodide of Berthelot, but differing from the lead ammonium iodides of Boullay and of Ditte, is obtained in crystals by dissolving lead iodide in a boiling concentrated solution of ammonium iodide. Strictly analogous, but anhydrous, double salts are obtained in a similar manner with tetramethylammonium, tetrethylammonium, and phenylammonium iodides. The iodide, $PbI_2,2NaI + 4H_2O$, is obtained in a similar way, and transparent, lemon-yellow crystals of the hydrate, $PbI_2,2NaI + 6H_2O$, separate from the mother liquor. Lithium iodide yields the salt $PbI_2,2LiI_2 + 4H_2O$ under analogous conditions, and iodides of the calcium group yield double salts of the type $2PbI_2,M''I_2 + 7H_2O$.

C. H. B.

Cupric Hydride. By EDWIN J. BARTLETT and WALTER H. MERRILL (*Amer. Chem. J.*, 1895, **17**, 185—189).—When the copper sponge formed by the decomposition of the cuprous hydride produced by the reaction between copper sulphate and hypophosphorous acid is left in contact with the acid, hydrogen continues to be evolved until the hypophosphorous acid is oxidised to phosphorous acid. Other forms of copper failed to produce this effect, except that obtained by reducing finely powdered cupric oxide with hydrogen; this led the authors to suspect that the copper sponge still contained hydrogen and was in reality a hydride. Analysis of the copper sponge indicated the presence of from 2·85 to 3·56 per cent. of hydrogen, corresponding with the formula CuH_2; the copper which had been reduced from oxide by hydrogen contained a similar percentage of hydrogen. It would seem therefore that the oxidation of the hypophosphorous acid only occurs in contact with this cupric hydride, and not in contact with copper (compare the action of palladium, Abstr., 1890, 690); the action is a continuous one and has no effect on the cupric hydride. The authors suppose that the hydride is a sufficiently strong reducing agent to determine the reduction of a water molecule by a hypophosphorous acid molecule.

Cupric hydride, when freshly prepared, is a reddish-brown, sponge-like mass, changing to a chocolate coloured powder when freed from acid and boiled for some time. On drying, it retains the latter appearance and does not oxidise hypophosphorous acid until it has been warmed with it, when the reddish colour and the sponginess return. It decomposes syrupy hypophosphorous acid with evolution of non-inflammable hydrogen phosphide. It reduces potassium chlorate to chloride in solution, also the nitrate to nitrite and ammonia,

and the ferricyanide to ferrocyanide. It has been found (Trans., 1878, **33**, 308) that the activity of the copper zinc couple is increased by ignition in hydrogen; this the authors ascribe to the formation of cupric hydride.
A. G. B

Atomic Weight of Yttrium. By Harry C. Jones (*Amer. Chem. J.*, 1895, **17**, 154—164).—The yttria used in this work was obtained from Rowland and had been purified as described by him (*Chem. News*, 1894, **70**, 68; Abstr., 1894, ii, 449); it might contain as a maximum ½ per cent. of other rare earths. To remove possible traces of calcium, magnesium, manganese, and iron, the author dissolved the yttria in nitric acid, and precipitated it with ammonia; the washed precipitate was then dissolved in nitric acid and precipitated by oxalic acid; the washed oxalate was ignited to obtain the purified base.

Two series of determinations were made; in the one the oxide was converted into sulphate by heating it with sulphuric acid and expelling the excess of acid; all necessary precautions were adopted and these are fully detailed in the paper. The mean value of 10 determinations in this series is 88·94, the maximum being 89·05, and the minimum 88·89 ($O = 16$). In the second series, yttrium sulphate was prepared by dissolving the oxide in sulphuric acid and crystallising, and this was heated in a platinum crucible over the blast-lamp until a constant weight had been obtained. The mean atomic weight from 10 determinations in this series is 88·97, the maximum being 89·03 and the minimum 88·89 ($O = 16$).

The author reviews the determinations which have previously been made and concludes that Cleve's value, which is about 0·15 higher than the author's number, 88·95, is the most correct of these. The true atomic weight is probably still a little lower than the last number.
A. G. B.

Hydrated Metallic Chlorides. By Henri Lescœur (*Bull. Soc. Chim.*, 1894, [3], **11**, 853—857).—A rejoinder to Sabatier (this vol., ii, 226). The author is guided in the search for hydrates by the vapour-pressures of the salts; Sabatier, by their heats of dissolution.

Manganous chloride crystallises from water with $4H_2O$, but with $2H_2O$ from concentrated hydrochloric acid; the latter hydrate is also obtained by heating the former at 20° or 100°. Magnesium chloride crystallises, with $4H_2O$ from water at 100°, or from concentrated hydrochloric acid. Ferrous chloride crystallises with $6H_2O$, not $4H_2O$. The cupric chloride crystallising with $4H_2O$ is not homogeneous; and the yellow salt obtained by drying this at 60—80° is monhydrated.
Jn. W.

Boron Steel. By Henri Moissan and Georges Charpy (*Compt. rend.*, 1895, **120**, 130—132).—When amorphous boron is fused with reduced iron, it yields a metal containing 10 per cent. of boron, and when this is added to previously fused soft steel, an iron containing boron 0·58, carbon 0·17, manganese 0·30 per cent., with traces of silicon, phosphorus, and sulphur can readily be obtained in large quantity. This alloy can be rolled, is readily worked at a dull red heat, but crumbles under the hammer if too strongly heated. On the whole, it behaves almost like soft steel.

Determinations of the rate of cooling at different temperatures show a critical point indicating a very considerable development of heat at about 1140°, the intensity of this development being of the same order as the recalescence of hard steels. The point is recognisable with iron containing various proportions of boron from 10 per cent. downwards. Feebly marked critical points can also be detected at 1040°, 830°, 730°, and 660°, the three latter apparently corresponding with the points a_1, a_2, and a_3 observed in ordinary soft steel at somewhat higher temperatures. These phenomena establish clearly the displacement of carbon by boron already observed by Moissan (this vol., ii, 220); the point 670°, which is so marked with ordinary iron containing carbon, disappears almost entirely and is replaced by the point 1140°.

Mechanical tests show that as regards the increase in the breaking strain by tempering, boron-steel behaves like a decidedly harder carbon-steel, although the diminution in the elongation is more marked with the latter. It is very remarkable, however, that tempering has no appreciable effect on the hardness of the boron-steel, and hence the influence of the boron is quite distinct from that of carbon.

C. H. B.

Iron Boride. By Henri Moissan (*Compt. rend.*, 1895, **120**, 173—177).—Iron boride is obtained by the action of boron chloride vapour on reduced iron at a dull red heat, or by the direct combination of iron with boron. In the latter case, soft iron is placed in a dish brasqued with boron and heated at 1100—1200° in an atmosphere of hydrogen in a tube placed in a coke fire, or the iron is placed in a carbon crucible brasqued with boron and heated in the electrical furnace for a few minutes with a current of 300 ampères and 65 volts, care being taken that the temperature is not too high, otherwise boron carbide will be formed. The product is heated with hydrochloric acid and the residue washed successively with water, alcohol, and ether.

The iron boride FeB thus obtained forms brilliant yellowish-gray crystals several millimetres long, sp. gr. at 18° = 7·15. It was the only compound obtained although experiments were made at various temperatures.

Iron boride does not alter in dry air or oxygen, but in moist air it becomes covered with an ochreous layer. It is attacked by chlorine at a red heat, with incandescence, and even more readily by bromine, with formation of a double iron boron bromide, but iodine and hydrogen iodide have no action even at 1100°. When heated in oxygen, it takes fire and then burns brilliantly without further extraneous heat. In all cases, amorphous iron boride is much more readily attacked than the crystallised compound, and since the action of oxygen on the boride is greatly accelerated by the presence of moisture and carbonic anhydride, the incandescence sometimes observed during the drying of impure amorphous boron may be attributed to the presence of amorphous iron boride.

The boride is attacked by sulphur and phosphorus at high temperatures. Potassium nitrate and potassium chlorate are without action at their melting points, but at higher temperatures attack the boride with incandescence. Fused alkali carbonates and hydroxides decomposed it rapidly and completely. Concentrated or dilute sulphuric acid has no action in the cold, but the boiling concentrated acid converts it into ferrous sulphate with evolution of sulphurous anhydride. Dilute hydrochloric acid has no action, but the hot concentrated acid attacks the boride slowly. Hydrofluoric acid also acts slowly, whether hot or cold. On the other hand, whilst very dilute nitric acid dissolves the boride only when hot, the concentrated acid attacks it with violence. G. H. B.

Combination of Nitric Oxide with Ferric Chloride. By V. THOMAS (*Compt. rend.*, 1895, **120**, 447—449).—Anhydrous ferric chloride absorbs nitric oxide at the ordinary temperature with formation of a brown compound, Fe_2Cl_6,NO; at 60°, the product is $2Fe_2Cl_6,NO$. The same compounds are formed under the same conditions of temperature when nitric oxide is passed into solutions of the ferric salt. At temperatures at which ferric chloride begins to sublime, it is reduced by the nitric oxide.

The ferric compounds are very hygroscopic, and could not be obtained crystallised; in contact with water, they give off nitric oxide, and, when heated in the air, they yield ferric oxide.

When nitric oxide is passed into ether saturated with ferric chloride, until no more gas is absorbed, and the liquid is evaporated over sulphuric acid, the compound $FeCl_2,NO + 2H_2O$ is obtained in black needles; if crystallisation takes place at 60°, it separates in anhydrous, yellow crystals. This compound dissolves completely in water, without evolution of gas, and yields a pale yellow solution, the colour of which deepens when heated. On addition of alkalis out of contact with air, ferrous oxide is precipitated, but no gas is evolved. The solution gives other reactions of ferrous salts, and the compound seems to be identical with that obtained by Graham by the action of nitrogen oxides on a solution of ferrous chloride. C. H. B.

Action of an Electric Current on Fused Metallic Sulphides. By JULES GARNIER (*Compt. rend.*, 1895, **120**, 184—185).—A crude nickel sulphide was fused in an earthenware tube provided with carbon electrodes, and was subjected to the action of a current of 10 volts and 23 ampères. The conductivity of the mixture remained very regular, but the voltage gradually diminished, although the temperature of the furnace was practically constant. The following table gives the composition of the original substance and of the products round the anode and cathode after passing the current for an hour and then cooling slowly.

	S.	Fe.	Ni.	Cu.
Original substance	21·10	33·30	16·30	29·00
Anode product..........	16·60	35·40	5·13	39·90
Cathode product........	4·70	49·10	19·10	26·13

The sulphur is, to a large extent, eliminated, probably as carbon bisulphide, and the remainder is concentrated at the anode. The quantity of nickel increases from the anode to the cathode, whilst that of copper increases in the reverse direction. The iron, on the whole, tends to accumulate at the cathode. C. H. B.

Amidochromates. By GRÉGOIRE WYROUBOFF (*Bull. Soc. Chim.*, 1894, [3], **11**, 845—853; compare Loewenthal, Abstr., 1894, ii, 383). —The author denies the existence of the amidochromates. Loewenthal's ammonium and potassium amidochromates are identical in crystallographic details with ammonium dichromate. The lithium salt is crystallographically identical with potassium dichromate, an impure lithium compound having probably been used in its preparation. The so-called amidochromates of fixed bases, moreover, do not appreciably lose weight when heated, and, when it is attempted to prepare them by acting on a chlorochromate with ammonia, no ammonium chloride is formed, as should be the case if Loewenthal's statements be correct.

The lithium chlorochromate is crystallographically identical with potassium chlorochromate. JN. W.

Titanium. By HENRI MOISSAN (*Compt. rend.*, 1895, **120**, 290—296).—When titanic anhydride is heated in a platinum dish using a current of 100 ampères and 50 volts, it yields a fused, or partially crystalline, deep indigo-blue mass of a lower oxide, which seems to be the monoxide mentioned by Laugier and by Karsten, and which is still under investigation. With a higher temperature, from a current of 300—350 ampères and 70 volts, the product is a fused mass of titanium nitride, Ti_2N_2. If titanium oxide and carbon are heated in a carbon dish in the tube of the electric furnace with a current of 1200 ampères and 70 volts, a crystalline mass of titanium carbide, TiC, is obtained, quite free from nitrogen. If a similar mixture with titanium oxide in excess is heated at the same temperature in a crucible, titanium is obtained, containing a variable proportion of carbon. With a current of 2200 ampères and 60 volts, the yield is better, each operation yielding about 200 grams of titanium. Below the titanium in the crucible is a layer of the nitride, and below this a layer of the blue oxide, hence it is clear that the temperature falls rapidly from the top of the crucible to the bottom.

The author regards these results as proof that the temperature of the arc is a continuous function of the current.

The proportion of carbon in the metal varies with the proportions in which the oxide and carbon were mixed. A mixture of titanic anhydride and titanium carbide, heated at the highest temperature already specified, yields a product containing about 4·8 per cent. of carbon, and if this is again heated with excess of the oxide a metal containing only 2 per cent. of carbon, and free from nitrogen and silicon, is obtained.

Titanium, thus prepared, has a brilliant, white fracture, and will scratch rock crystal and steel, but is very friable; sp. gr. = 4·87. It is attacked by chlorine at 325° with incandescence, and by bromine at 360° with incandescence, but by iodine only at a higher temperature, and without incandescence, the product being the solid iodide. In oxygen it burns at 610°; in sulphur vapour, at the softening point of glass, it forms a dark coloured sulphide, which is not affected by cold hydrochloric acid, but is attacked by the boiling concentrated acid; in nitrogen at about 800° the powdered metal is converted into nitride with development of heat; phosphorus at 1000° converts it superficially into a dark coloured phosphide.

Carbon dissolves in fused titanium and forms a definite carbide, any excess separating as graphite; boron and silicon yield a fused or crystalline boride or silicide as hard as the diamond. Titanium dissolves in iron and lead, and it forms alloys with tin and chromium.

Titanium is attacked by concentrated boiling hydrochloric acid with evolution of hydrogen and formation of a violet solution; slowly by nitric acid, but more rapidly by aqua regia; more readily by dilute sulphuric acid in the cold, with liberation of hydrogen and production of a violet solution, also by the hot concentrated acid, with evolution of sulphurous anhydride; very readily with effervescence by a mixture of nitric and hydrofluoric acids. It is also attacked without development of heat by fused potassium nitrate, readily with brilliant incandescence by fused potassium chlorate, and also with incandescence by fused alkali carbonates, alone or mixed with potassium nitrate. Powdered titanium decomposes steam at about 700°, but the reaction is not continuous below 800°. It reduces silver fluoride at 320° with incandescence.

Titanium carbide, TiC, is obtained by the action of an arc from a current of 1000 ampères and 70 volts on a mixture of titanium oxide with excess of carbon, and is a fused mass with a crystalline fracture, or is partially crystallised; sp. gr. 4·25. It is not attacked by hydrochloric acid and only slowly by aqua regia, and it does not decompose steam at 700°, but in other respects its reactions are similar to those of titanium, except that it burns much more readily in oxygen.

Titanium nitride, Ti_2N_2, obtained under the conditions already described, is a bronze-yellow mass of sp. gr. 5·18; it scratches rubies and will cut diamonds. C. H. B.

Bismuth Sulphide. By ALFRED DITTE (*Compt. rend.*, 1895, **120**, 186—188).—Amorphous precipitated bismuth sulphide dissolves readily in a cold solution of potassium sulphide, in proportion increasing with the quantity of alkali sulphide present, and forms a red solution. If an excess of bismuth sulphide is added and the liquid is heated, a further quantity dissolves, and, when the solution is sufficiently concentrated and is allowed to cool, it deposits very brilliant, transparent, highly refractive, reddish-yellow rhombohedra, of the composition $Bi_2S_3,4K_2S + 4H_2O$. The crystals effloresce in dry air, and in moist air become covered with a black film of bismuth sulphide. They are immediately decomposed by water with separation of bismuth sulphide, and a similar decomposition takes place on adding a small quantity of water to their mother liquor.

If the amorphous sulphide is placed in a solution of potassium sulphide just sufficiently concentrated to form a small quantity of the double salt, and if the liquid is heated in such a way that the temperature is not uniform, the double sulphide will form in the cooler parts and be decomposed in the hotter parts, and the bismuth sulphide will separate in a crystalline form, not readily attacked by the alkali sulphide. In this way, the whole of the bismuth sulphide may become crystalline, as in the case of silver sulphide (this vol., ii, 223). The crystals are small, have the colour and lustre of graphite, soil the fingers, and generally resemble the natural sulphide.

Bismuth sulphide is only slightly soluble in cold saturated solutions of sodium sulphide, and, although on heating the solution, and allowing it to concentrate at the same time, the solubility increases sufficiently to produce a small quantity of double salt, and thus convert the bismuth sulphide into the crystalline form, the liquid does not deposit the double sulphide. C. H. B.

Gold Sulphide. By ALFRED DITTE (*Compt. rend.*, 1895, **120**, 320—322).—When hydrogen sulphide is passed into a neutral solution of gold chloride, the gold sulphide remains in solution and can pass through a filter, but after some time it separates in a colloidal condition. A small quantity of hydrochloric acid causes immediate precipitation of the sulphide as a black powder.

If the insoluble gold sulphide is mixed with excess of sodium monosulphide, it dissolves to an orange-red solution from which colourless slender needles of the double sulphide, $Au_2S,2Na_2S + 20H_2O$, separate on concentration. This compound is very soluble in water, and acids precipitate gold sulphide from the solution. With very slight excess of the alkali sulphide, slender needles of the sulphide, $Au_2S,Na_2S + 10H_2O$, are obtained, whilst the mother liquor contains the disulphide Na_2S_2. It is clear that in contact with sodium sulphide, auric sulphide is reduced to aurous sulphide, which then forms stable double sulphides.

If the gold sulphide is in excess, a small quantity only dissolves and the residue contracts and after some days consists of a dense greenish-yellow crystalline powder of metallic gold. At first aurous sulphide and sodium disulphide are found, but the latter continues to remove sulphur from the gold sulphide until the alkali polysulphide is saturated with sulphur. The double gold sodium sulphide decomposes similarly in contact with the excess of gold sulphide. Alkali polysulphides saturated with sulphur have no action on either gold sulphide or metallic gold.

With potassium sulphide, similar phenomena are observed, but the alkali sulphide and the double sulphide being much more soluble, the isolation of the latter in a pure state is more difficult. The double sulphide, $Au_2S,4K_2S_2 + 12H_2O$, is formed in presence of a slight excess of potassium sulphide and crystallises in needles.

C. H. B.

Complex Inorganic Acids. By WOLCOTT GIBBS (*Amer. Chem. J.*, 1895, **17**, 167—185; compare this vol., ii, 229).—A solution of aurosodium pyrophosphate, $AuNaP_2O_7$, yields with ammonia a white precipitate, presumably *sodium auramine pyrophosphate*,

$$14Au_2O_3,6P_2O_5,14NH_3,3Na_2O + 24H_2O,$$

which rapidly becomes yellow and crystalline; when heated above 170° it explodes, indicating that a part of the gold is present in the form of an auramine; when boiled with barium chloride, it yields a yellow crystalline salt, and a silver salt is obtained on the addition of a cold solution of silver nitrate; both these salts were analysed, but the figures show that in neither case does a simple double decomposition occur between the auramine and the precipitant. Other reactions are described and the author considers the possible constitution of the salt.

An *auropyrophosphomolybdate*,

$$22MoO_3,4P_2O_7AuNa,6Au_2O_3,15(NH_4)_2O + 5H_2O,$$

is obtained as a buff-coloured precipitate when a solution of sodium auropyrophosphate is boiled with one of ammonium molybdate; it does not explode when heated. By boiling with ammonium molybdate, the orange-coloured precipitate which ammonia produces in a solution of sodium auropyrophosphate, a pale, yellowish crystalline salt is formed; this appears to be an *auramine pyrophosphomolybdate*, $12Au_2O_3,3MoO_3,7P_2O_5,24NH_3 + 21H_2O$; it explodes when heated.

The author gives the results of some preliminary work on molybdicotungstates, uranosotungstates, silicomolybdates, selenosomolybdates, selenosotungstates, telluroso-molybdates and -tungstates, and cericomolybdates, and describes a new phosphotungstate of the formula $20WO_3,P_2O_5,Na_2O,2H_2O + 19Aq$. A. G. B.

Mineralogical Chemistry.

Succinite (Amber). By ALEXANDER TSCHIRCH and E. AWENG (*Arch. Pharm.*, 1894, **232**, 660—688; see this vol., i, 384).

Cassiterite. By W. KOHLMANN (*Zeit. Kryst. Min.*, 1895, **24**, 350—365).—Descriptions and measurements of crystals from numerous localities are given under Becke's three types: (1) crystals with equal extension of the vertical and lateral axes, no basal plane and frequently twinned (characteristic of the Erzgebirge); (2) "needle-tin," with an acute pyramid largely developed (Cornwall); (3) basal plane prominent (Pitkäranta). A fourth type is added, in which the pyramid *s*(111) predominates. A complete list of crystal forms is given. The variations in colour of the mineral are described, and the colour of a yellow crystal from Perak is attributed (doubtfully) to tungsten; the crystal giving on analysis—

SnO_2.	WO_3.	FeO.	Total.
99·90	0·11	0·12	100·13

The modes of occurrence and associated minerals from different localities are described. L. J. S.

Artificial Spinel and Corundum. By J. MOROZEWICZ (*Zeit. Kryst. Min.*, 1895, **24**, 281—285).—The analysis of a well crystallised silicate fusion containing plagioclase, nepheline, olivine, magnetite, and 14·45 per cent. of corundum is given under I. The corundum occurs as tabular or pyramidal crystals of a silver-white or yellowish colour, and consists of 99·5—99·8 per cent. of Al_2O_3; sp. gr. 4·012. II gives the analysis of a slag containing plagioclase, olivine and 7·21 per cent. of spinel; the latter occurs as simple and twinned octahedra of a yellowish colour; sp. gr. 3·45.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	Total.
I.	37·24	29·29	2·91	4·10	0·54	5·04	6·93	100·50
	Corundum	14·45	—	—	—	—	—	
II.	37·79	31·17	3·17	5·62	7·80	1·83	5·12	99·71
	Spinel . . .	4·74	0·59	—	1·94	—	—	

It is thus proved that these minerals could separate directly from volcanic magmas, containing an excess of alumina (over 30 per cent.), without the aid of "mineralising agents." L. J. S.

Pyrogenetic Corundum. By ALEXANDER E. LAGORIO (*Zeit. Kryst. Min.*, 1895, **24**, 285—296).—The corundum of volcanic rocks has previously been assumed to owe its presence by being brought up from below with the magma, or to the action of "mineralising agents." The known occurrences in volcanic and contact rocks are enumerated, and the associated minerals mentioned. This corundum, the typical habit of which is tabular, is confined to rocks containing more than 30 per cent. of alumina; such rocks are however rare, there being no volcanic rocks and even few clay slates. An analysis of an enclosure in andesite from Bockberg, with 47·43 per cent. Al_2O_3, which contains corundum and spinel, is quoted, as well as analyses of some contact rocks containing a high percentage of alumina. Experiments have been made on the solubility of corundum and other infusible minerals rich in alumina, in different silicate fusions (trachyte, andesite, leucite, &c.); the solubility is greater in fusions poor in alumina. The meaning and limitations of the term "mineralising agent" are discussed. L. J. S.

Sulfoborite. By HUGO BÜCKING (*Jahrb. f. Min.*, 1895, i, Ref., 253—254; from *Ber. Ak. Berlin*, 1893, 967—972).—Sulfoborite from the salt-beds of Westeregeln, Stassfurt, gave on analysis—

MgO.	SO_3.	H_2O.	B_2O_3 (diff.).
32·91	21·95	21·50	(23·64)

The formula is given as $3MgSO_4,2Mg_3B_4O_9,12H_2O$; sp. gr. 2·38—2·45. The transparent, colourless, or slightly reddish crystals are rhombic with $a : b : c = 0·6196 : 1 : 0·8100$. L. J. S.

Apophyllite from Grängesberg. By GUSTAF HALLBERG (*Jahrb. f. Min.*, 1895, i, Ref., 268—269; from *Geol. För. Förh. Stockh.*, 1893, **15**, 327).—Apophyllite occurs in radial and platey aggregates in stephanite (Schwarzerz) with apatite, calcite, magnetite and pyrites. Analysis gave—

SiO_2.	Al_2O_3.	CaO.	Na_2O.	K_2O.	H_2O.	F.	Total.
51·96	0·30	25·0	0·43	4·10	16·96	0·86	99·61

Total, substituting F for O (0·36), = 99·25. In convergent polarised light an optic axial angle of about 10° was observed, with the usual interference colours; optically positive. L. J. S.

Tourmaline, Gypsum and other Minerals from Bohemia. By FRIEDRICH KATZER (*Zeit. Kryst. Min.*, 1895, **24**, 428; from *Tsch. Min. Mitth.*, 1891, **12**, 416, 1891).—The modes of occurrence, &c., of several minerals (*e.g.*, mispickel, blende, galena, siderite, quartz, gypsum, wollastonite, andalusite, cordierite, &c.) from various localities are described. Analysis of tourmaline from Kuhrau gave—

SiO_2.	Al_2O_3.	B_2O_3.	FeO.	Fe_2O_3.	MnO.	CaO.	MgO.
36·28	31·59	8·76	7·25	6·79	1·41	0·92	2·60

Na_2O.	K_2O.	F.	H_2O.	Total.
1·28	0·41	0·59	2·51	100·39

Gypsum from Mergeln gave—

CaO.	SO_3.	SiO_2.	$Al_2O_3 + Fe_2O_3$.	H_2O.	Total.
32·29	45·91	0·41	0·19	20·52	99·32

L. J. S.

Vulcanite, a New Rock. By WILLIAM H. HOBBS (*Jahrb. f. Min.*, 1895, i, Ref., 315—316; from *Zeits. deuts. geol. Ges.*, **45**, 578—593).—Vulcanite, an anorthoclase-augite rock forms the crust of blocks ejected from Vulcano in April, 1893; it consists of a glassy base with porphyritic and microlitic felspar and augite, and enclosures of altered dolerite and liparite. The felspar is partly anorthoclase, I gives the analysis of that having a density between 2·56 and 2·60; II the augite; III the bulk analysis of the rock (which is compared with dacite); and IV the ground mass.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	K_2O.	Na_2O.	H_2O.
I.	60·01	20·12	2·82		0·23	5·15	3·67	6·43	0·77
II.	47·60	4·66	—	12·73	14·56	18·06	—	1·50	0·50
III.	66·99	17·56	1·41	3·39	0·93	4·25	0·34	3·35	1·53
IV.	67·55	18·04	1·18	3·15	0·74	3·03	0·11	4·39	1·06

L. J. S.

Physiological Chemistry.

Radiation at Low Temperatures and its Employment for Therapeutic Purposes. By RAOUL PICTET (*Zeit. physikal. Chem.*, 1895, **16**, 417—449; see this vol., ii, 253).

The Glycolytic Ferment. By RAPHAEL LÉPINE (*Compt. rend.*, 1895, **120**, 139—141).—When the pancreas taken from a dog is crushed under aseptic conditions immediately after its removal from the animal, and digested for some time at 38° with very dilute sulphuric acid (2 : 1000), the solution shows a glycolytic power much higher than that of a fresh pancreas macerated in water containing no acid. It follows that, under the influence of the acid, the glycolytic ferment is produced, probably by hydrolysis, just as, according to Heidenhain, it is developed from trypsin in a pancreas macerated with very dilute sulphuric acid. The author considers, however, that the glycolytic ferment is derived from diastase. He finds that when purified commercial diastase is heated for two or three hours at 38° with very dilute sulphuric acid (1 : 1000) the solution loses its saccharifying power, but acquires a well-marked glycolytic power. A similar effect is produced by the action of dilute sulphuric acid on human saliva and on the pancreatic juice itself. It was also observed that during the excitation of the nerve and withdrawal of the pancreatic juice by means of a cannula, the blood of the pancreatic vein had no marked glycolytic power, but acquired this power after some time when there was no flow of pancreatic juice. This balance between the internal and external secretions of the pancreas is under investigation. C. H. B.

Digestion of Pseudo-nucleïn from Caseïn. By JOHN SEBELIEN (*Zeit. physiol. Chem.*, 1895, **20**, 443—454).—The pseudo-nucleïn from caseïn (see Hammarsten, Abstr., 1894, i, 310) is of varying composition, and the present research confirms that of Moraczewski (this vol., ii, 54) on the subject. In pancreatic digestions, caseïn is almost completely digested. W. D. H.

Digestibility of Pentosans. By HUGO WEISKE (*Zeit. physiol. Chem.*, 1895, **20**, 489—497).— A review of the previous work on the subject shows that the nutrition value of pentosans is by no means settled. Some researches on the lower animals indicate that these substances form a source of glycogen; in other cases, especially in human beings, they appear to pass unchanged into the urine. The present research, carried out on sheep and rabbits fed on oats and wheat straw, shows that a considerable quantity of the pentosans present in the fodder disappears from the intestines; in the sheep, 62—66 per cent. disappears from the fæces; in the rabbit, the number is 51—55 per cent. This, however, does not necessarily imply that all this had been absorbed, as some might have gone, from the decomposition produced by bacteria, into simple and useless material. W. D. H.

Phosphorus and Sugar yielding Constituents of Liver and Suprarenal Bodies. By PAUL MANASSE (*Zeit. physiol. Chem.*, 1895, **20**, 478—488).—It has long been known that the medullary substance of the suprarenal capsules contains a substance which becomes dark brown with salts of chromic acid, unless the capsules have been previously hardened in alcohol. The substance is soluble in alcohol, and shows great similarities to the substance named jecorin, first separated by Drechsel from the liver (Abstr., 1886, 636; 1888, 1313). The resemblance to lecithin noted by Drechsel is accentuated by the fact that, as the present research shows, it yields choline, glycero-phosphoric acid, and fatty acids on decomposition. The carbohydrate obtainable from it, and to which it owes its reducing power, appears by its properties to be most like dextrose.

The substance obtainable from the suprarenals has a general resemblance to jecorin, but differs from it in some of its solubilities, and in the fact that it does not reduce alkaline solutions of copper hydroxide until after prolonged boiling with sulphuric acid; the sugar then formed appears to be dextrose. The following percentage compositions are given.

	Jecorin.		Substance from suprarenals.
	Drechsel.	Baldi.	
C..........	51·32—51·64	46·88—46·89	41·43
H..........	8·11— 8·25	7·81— 8·09	7·16
N..........	2·86	4·36— 4·88	0·3
S..........	1·42— 1·47	2·14— 2·70	1·8
P..........	2·2 — 3·7	2·29— 2·75	4·44
Na.........	2·72	5·72	—
O..........	30·10	—	—

W. D. H.

The Silvery Substance in the Skin of Alburnus Lucidus. By ALBRECHT BETHE (*Zeit. physiol. Chem.*, 1895, **20**, 472—477).—The silvery material in the scales of certain fishes is crystalline, and, according to the most trustworthy of previous researches, consists of guanine. The correctness of this hypothesis is confirmed in the present research for the case of *Alburnus lucidus*. W. D. H.

Oyster Shells. By G. ADOLPHE CHATIN and ACHILLE MUNTZ (*Compt. rend.*, 1895, **120**, 531—534).—Analysis of the shells of oysters from various sources show that 100 parts of dry shell contain N, 0·05—0·14; SiO_2, 0·44—1·60; CaO, 48·44—53·70; P_2O_5, 0·019—0·089; SO_3, 0·779—1·004; MgO, 0·340—0·570; Fe, 0·011—0·037; Mn, 0·009—0·017; S (as sulphide), 0·015—0·020; organic matter, 0·90—1·00; F, 0·015—0·020; I, 0·003; Br, 0·005; CO_2, 43·329—48·122.

The proportion of phosphoric anhydride is considerably higher in the shells of Portuguese oysters than in any others, the usual amount being 0·04—0·05.

The composition of the shells justifies to some extent their use as a manure and in ancient medical practice. C. H. B.

Acidity of Urine. By ERNST FREUND and GUSTAV TOEPFER (*Zeit. physiol. Chem.*, 1895, **20**, 455—459).—Polemical, being chiefly concerned in answering the objections of Lieblein (this vol., ii, 55) to the methods previously described by the authors (Abstr., 1894, ii, 260). W. D. H.

Effect on Butter of Feeding with Sesame and Cotton Cakes. By V. Stein (*Bied Centr.* 1895, **24**, 93—94).—See this vol., ii, 299).

Behaviour of Acid-imides in the Animal Organism. By Fr. Koehne (*Chem. Centr.*, 1894, ii, 296; from *Inaug. Diss.*, Rostock, 1894).—Succinimide is almost completely destroyed in the animal organism without affecting the health of the animal. The sodium compound of dibenzamide is destroyed and expelled as hippuric acid. Phthalimide is almost completely destroyed without affecting the health of the animal, but the ethereal hydrogen sulphates in the urine are somewhat diminished by this compound. Benzoylcarbamide is without influence on the organism, and is destroyed and expelled as hippuric acid. Ethyl allophanate is without action on the organism and is completely destroyed. On the other hand, biuret, diphenylbiuret, and diphenolbiuret pass through the organism without change. The two latter when administered in large doses cause vomiting. Carbonyldicarbamide is also for the most part recovered unaltered in the urine. In contradistinction to these biurets, the corresponding ring compounds are completely destroyed by the animal organism. Benzylidenbiuret is expelled as hippuric acid; cyanuric acid, which might be expected to appear in the urine, is absent, as this also is completely decomposed. Parabanic acid behaves like cyanuric acid. Alloxan and alloxantin are also in a great measure destroyed, and are expelled in the urine in small quantities as parabanic and oxalic acids. E. C. R.

The Blood in Cancer. By Waclaw v. Moraczewski (*Virchow's Archiv.*, 1895, **139**, 385—405).—The blood was examined in a number of cases of cancer and other diseases, the phosphates, chlorides, hæmoglobin, total solids, and nitrogen being determined. From the tables given, there appears very little of a constant change from the normal. A diminution in the amount of phosphates in the blood of cancerous patients seems not to be due so much to the new growth as to the anæmia it produces; the chlorides increase proportionately to the fall in the phosphates; and the proportion of chlorides in the urine to chlorides in the blood falls. A high percentage of nitrogen in the blood distinguishes cancer and also scurvy from simple anæmia. In pulmonary stenosis and asthma, the total solids are high. W. D. H.

The Contents of Two Lymph Cysts. By Richard v. Zeynek (*Zeit. physiol. Chem.*, **20**, 1895, 462—471).—Short details of the cases are given, and former literature referred to. The composition of the fluid removed may be stated in tabular form as follows.

		Case II.	
	Case I.	1st tapping.	2nd tapping.
Total proteïd........	5·069	3·794	4·066 gr. per cent.
Fat (ether extract) ..	8·024	2·312	4·1 ,,

Total solids	14·887	7·463	9·067
Ash................	0·908	0·764	0·804

The ash from Case I gave—

Soluble in water.							
SO_3.	Cl.	P_2O_5.	CO_2.	CaO.	MgO.	K_2O.	Na_2O.
0·07	0·323	0·009	0·049	0·015	0·004	0·021	0·380

Insoluble in water.				
P_2O_5.	CaO.	MgO.	CO_2 (diff.).	SO_3.
0·021	0·058	0·0005	0·035	0·013

These fluids were milky; the percentage both of proteïd and fat was high. The proteïds present were chiefly serum-albumin, small quantities of globulin, traces of a phosphorised proteïd, and a variable amount of fibrin, which may be absent. Caseïn and peptone are absent. The fat includes not unimportant quantities of cholesterol, and traces of lecithin. Sugar was absent. Soaps and a small amount of urea were present in both cases. The fluid was found to be very resistent to bacterial action. W. D. H.

Levulose and Diabetes. By KARL BOHLAND (*Chem. Centr.*, 1894, ii, 890—891; from *Therap. Monatsh.*, **8**, 377—381).—Cases of severe diabetes are recorded in which small doses of levulose produced a great rise in the excretion of sugar, greater than that due simply to the dose given. Hence Külz's statement that diabetics are tolerant of levulose is not universally true. The use of *Syzygium Jambolanum* and piperazine in diabetes gave good results. W. D. H.

Excretion of Acetone, Diacetic acid, and β-Hydroxybutyric acid in Diabetes. By W. WEINTRAUD (*Chem. Centr.*, 1894, ii, 891—892; from *Arch. exp. Path. Pharm.*, **34**, 169—184).—The separation of these substances from the body is regarded as due to deficiency of oxidative processes. In the normal state, they are easily burnt off as carbonic anhydride. They may be regarded either as intermediate products of normal metabolic processes, or may, on the other hand, be due to a quantitative alteration in nutritional exchanges. This question is not yet ripe for settlement. Recent workers regard proteïd matter as the source of these three substances; but in the present research no evidence to support this view is derived from investigations on nitrogenous metabolism. The presence of hydroxybutyric acid in the urine should lead one to expect diabetic coma; and there is no parallelism between the excretion of this substance and that of acetone; as the acid diminishes, acetone does not increase; this is against the hypothesis that the acid is the source of acetone. The administration of sodium carbonate increases the acetone in the urine, but without correspondingly lessening the hydroxybutyric acid. Administration of organic acids including optically inactive hydroxybutyric acid increases these substances in the urine, but does not influence the acetonuria. Carbohydrate diet markedly lessens acetonuria; so does glycerol, as Hirschfeld showed first. Glycerol has a similar effect on the excretion of hydroxybutyric acid, but it increases the glycosuria.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Effect of Oxygen on Alcoholic Fermentation. By D. Iwanowsky (*Bied. Centr.*, 1895, **24**, 120—121; from *Bot. Centr.*, 1894, **58**, 344).—A pure cultivation of beer yeast showed the same fermentative energy in presence of oxygen as in absence of oxygen.

A sugar solution was dropped at the rate of six or seven drops per minute on to yeast spread on a porous plate, the excess of solution passing through the plate into a vessel containing salicylic acid. The energy of fermentation was increased. But this was due to the continual removal of the alcohol, which, when present, hinders fermentation, and not to increased aëration. Similar experiments, conducted in oxygen and in nitrogen respectively, gave the same energy of fermentation.

The fermentative energy of yeast cells is, therefore, not influenced by oxygen, and no amount of aëration will enable the cells to respire like aërobic organisms; in this respect, there is an essential difference between yeast and the higher plants. N. H. J. M.

Alcoholic Fermentation. By N. v. Chudiakow (*Bied. Centr.*, 1895, **24**, 122—128; from *Landw. Jahrb.*, 1894, **23**, 391).—Fermentation in pure dilute sugar solution in presence of air is not lasting. In cases where fermentation continues, a portion of the yeast dies and changes the composition of the substratum; fermentation is accompanied with increase of yeast cells. The cessation of fermentation and dying off of the yeast cells is generally quicker at higher temperatures.

Fermentation in pure sugar solution is about 3·5 times more favourable in absence of air than in presence of oxygen. Oxygen does not assist fermentation as Nägeli maintains (*Theorie d. Gâhrung*, 1879), but makes it impossible (in pure sugar solution). The better the nutritive solution, the less is the unfavourable effect of oxygen, until with worts and peptone, oxygen has no effect at all (compare Iwanowsky, preceding abstract).

For the multiplication of yeast cells, oxygen is necessary when the nutritive solution is poor, but is almost unnecessary when sugar-peptone solution and worts are employed. This is in confirmation of Nägeli's and Mayer's results. In the experiments recorded, oxygen was in every case unfavourable to fermentation when necessary for multiplication; in all solutions, for instance, in which nitrogen was present in the form of ammonium salts. When, on the other hand, oxygen is not required for multiplication, it also is without injurious effect on fermentation. The reasons of this relation between multiplication and activity as ferment seems to be connected with the nitrogen change in the yeast cells.

The activity of yeast as ferment rises with increase of temperature up to 45°, at which temperature the cells are killed. The presence or absence of oxygen is immaterial.

Apparent intramolecular respiration only occurs when yeast contains bacteria, or when the yeast cells still contain sugar. There is no intramolecular respiration in yeast, which in this respect resembles the moulds. N. H. J. M.

Albuminous Fermentation. By Fritz Obermayer and Richard Kerry (*Chem. Centr.*, 1894, i, 825; from *Centr. Physiol.*, **7**, 806).—Yeast was mixed with water and partly inoculated with a few drops of decomposing blood, partly with fresh fæces, and then allowed to remain at the propagating temperature for 10—14 days. From the acid liquid thus obtained the yeast cells were precipitated by the addition of barium hydroxide and zinc sulphate. By Baumann and Udrański's method, from 2½ kilos. of yeast, 60 grams of dibenzoyldiamines were obtained and identified as the dibenzoates of putrescine and cadaverine. From the filtrate of these dibenzoates, a new *benzoate*, $C_{28}H_{29}N_3O_5$, was obtained by extraction with ether. This melts at 117—118° and is soluble in hot water, alcohol, ether, and benzene, insoluble in petroleum and carbon bisulphide. The liquid, after extraction with ether, was treated with sulphuric acid to free it from benzoic acid, neutralised with barium or calcium carbonate, and evaporated. The residue, after treatment with sulphuric acid, gave, when extracted with ether, the usual fatty acids, and a *compound*, $C_{27}H_{30}N_4O_6$, which melts at 122·5° and yields a soluble sodium salt melting at 126—127°. The above compounds, $C_{28}H_{29}N_3O_5$ and $C_{27}H_{30}N_4O_6$, each contain three benzoyl groups, and are probably derivatives of heptoic and caproic acids. Egg-albumin, peptone, and gelatin yield the above compounds in small quantities. Yeast when treated with *Bacterium coli* did not yield diamines, and with *Bacillus proteus*, very small quantities only. Diamines are not formed either by boiling yeast with acids, or by melting albumin with potassium hydroxide. E. C. R.

Assimilation of Free Atmospheric Nitrogen by Microbes. By Sergei Winogradsky (*Arch. Sciences Biol.*, 1895, **3**, 297—352).—By means of "elective" cultivation—that is under conditions as exclusive as possible—a butyric ferment, which has the power of fixing free nitrogen, was isolated from other soil organisms. For this purpose, a nutritive solution was employed containing, besides mineral food, 2 to 4 per cent. of dextrose, prepared by Soxhlet's method, and quite free from nitrogen. Various moulds and small bacteria, &c., which seemed to be superfluous, were destroyed by heating for 10 minutes at 75°.

As regards the relation between sugar decomposed and nitrogen fixed, for every gram of sugar, the amount of nitrogen was about 2·5 to 3 milligrams—that is, under the conditions of the experiments. With increased amount, or perhaps greater concentration of sugar, there seems to be less nitrogen fixed. There is also less fixation with imperfect aëration. The presence of a small amount of ammonia in the cultivations had either the effect of accelerating the fermentation at first, or it had no effect, according to the conditions. Larger amounts of ammonia (about 8 milligrams) reduced the fixation, whilst twice that amount checked fixation almost entirely.

The microbe, which is called *Clostridium Pasteurianum*, could not be identified with any known ferment, but morphologically it most resembles Prazmowski's *Clostridium butyricum.* The nitrogen which is fixed is mainly in an insoluble, organic form. The liquid products of the fermentation are chiefly butyric, with some acetic acid, whilst the gas evolved consists of hydrogen (60—75 per cent.) and carbonic anhydride. The quickest and surest way of isolating the microbe was to introduce a trace of soil into the saccharine solution (free from combined nitrogen) and to pass nitrogen through it; after making three to five passages in the same medium, the spores are heated for a quarter of an hour at 80°; finally, strictly anærobic potato cultures are made.

Pure cultivations of *Clostridium* do not give cultivations in gelatin or broth, which are too nitrogenous.

The methods employed in the investigation are fully described, and the results given in tables.

In conclusion, two series of experiments are described which were made in order to see whether other nitrogen-fixing organisms could be obtained from soil, Berthelot having stated that there are organisms of very different kinds, especially certain soil bacteria, which have this power. The results of the experiments, which were made under a variety of conditions, show that none of the 15 microbes obtained fixed nitrogen to an appreciable extent; *Clostridium* alone, as before, was found to be able to assimilate nitrogen. The microbes were, moreover, unable to utilise the carbohydrate in absence of combined nitrogen. In potato cultivations, two microbes, which were able in presence of combined nitrogen to assimilate very slight amounts of nitrogen, were obtained.

The power of fixing nitrogen does not therefore seem to be at all general among microbes, and is probably a quite specific function; and the ability to exist without combined nitrogen also seems to be possessed by *Clostridium* alone. N. H. J. M.

Alumina in Plants. By MARCELLIN BERTHELOT and GUSTAVE ANDRÉ (*Compt. rend.*, 1895, **120**, 288—290).—Roots of lucern contain 0·45—0·5 per cent. of alumina, those of convolvulus 0·4 per cent., those of couch grass 0·12 per cent.; these quantities being of the same order as those of other metallic oxides. The alumina is associated with phosphoric acid. The leaves of lupin, on the other hand, contained only 0·037 per cent., and those of the lime only 0·0025 per cent., hence it would seem that the greater part of the alumina is arrested in the roots, and it is noteworthy that the plants containing marked quantities of alumina have abundant and deep roots. Aluminium phosphate and alumina can dissolve, and hence can be absorbed, in presence of citric, tartaric, and similar acids.

C. H. B.

Carbohydrates of the Gum of Acacia Decurrens. By WINTHROP E. STONE (*Amer. Chem. J.*, 1895, **17**, 196—199).—The gum of *Acacia decurrens* contains a complex carbohydrate of the galacto-araban character, and does not differ essentially from gum-arabic, peach-gum, or cherry-gum. A. G. B.

Basswood Oil. By F. G. WIECHMANN (*Amer. Chem. J.*, 1895, **17**, 305—308).—The author has examined two specimens of basswood (*Tilia Americana*), from Saginaw, Michigan. (1) Sound wood, (2) wood which had been kept in water for some time, and certain constituents of which had undergone decomposition. On extracting the powdered wood, oils were obtained which greatly resembled cotton-seed oil. The oils are apparently glycerides, as on hydrolysing with potash they yield glycerol and a mixture of fatty acids (mainly butyric). J. J. S.

Sap of the Lac Tree. By GABRIEL BERTRAND (*Bull. Soc. Chim.*, 1894, [3], **11**, 717—721).—See this vol., i, 385.

Moâbi Seeds. By H. LECOMTE and ALEXANDRE HÉBERT (*Compt. rend.*, 1895, **120**, 374—377).—The moâbi is a large tree, which grows in parts of the French Congo; its very thick bark yields a milky juice, containing a somewhat large proportion of gutta percha. Its seeds closely resemble those of *Tieghemella Heckelii* (Pierre), and are 50 mm. long, 30 to 35 mm. broad, and 25 mm. thick; they consist of a kernel enclosed in an integument about 1 mm. thick.

One hundred parts of decorticated seeds consist of 36 parts of rind and 64 parts of kernel. The former contains small quantities of nitrogenous compounds and fat; the latter contains, after removal of the fat by benzene, ash, 4·40 per cent.; total nitrogenous compounds, 12·81 per cent. (nitrogen 2·05 per cent.), sugars 4·07 per cent., extractive matters 13·43 per cent., cellulose 18·75 per cent., resin 12·36 per cent.; it is therefore valuable as a manure or cattle food.

The fat is yellowish, melts at 32—33°, and solidifies at 25—26°; sp. gr. at 30° (liquid) = 0·894. It yields 88 per cent. of white, fatty acids melting at 45—46°, and containing about equal parts of liquid and solid acids. The liquid acid is oleic acid; the solid acids consist mainly of palmitic and stearic acids, with probably some myristic and margaric acids. C. H. B.

Peculiar Property of Phosphoric acid in Peaty Soil. By BRUNO TACKE (*Bied. Centr.*, 1895, **24**, 82—84; from *Mitt. d. Ver. z. Förd. d. Moorkultur.*, 1894, No. 21).—It was noticed that when peaty soils, on which crops fail unless manured with phosphates, are left for some years and become dried up, they will then generally give good yields without phosphate manuring. Experiments are described in which plants were grown in pots containing peaty soil manured with lime, kainite, and sodium nitrate. The soil was used (1) in its original state, (2) after being dried at 50°, (3) dried at 100°, and (4) dried at 180°. The results, showing amount of produce, phosphoric acid in dry produce, and total phosphoric acid removed per pot, are given in a table. By drying at a low temperature, about four times as much produce was obtained as in the fresh soil, whilst the percentage of phosphoric acid in the pyoduce was nearly doubled. The soil dried at 180° gave less produce than the soil dried at 50°; but the percentage of phosphoric acid was more than twice as high. Whilst the soil in its original state only gave up 1·8 per cent. of its phosphoric acid, the soil dried at 180° gave up nearly 20 per cent.

It is suggested that the greater availability of the phosphoric acid in the soils which had been dried may be due (1) to the liberation of phosphoric acid from organic phosphorus or phosphatic compounds, (2) to the destruction of so-called colloïd substances which held back the phosphates, and (3) the formation (with or without co-operation of oxygen) of strongly acid compounds which decomposed insoluble phosphoric acid compounds present in the soil.

N. H. J. M.

Loss of Nitrogen in Drainage Waters. By J. J. THÉOPHILE SCHLOESING (*Compt. rend.*, 1895, **120**, 526—530).—With a view to estimate the actual loss of nitrogen in drainage waters that have percolated through the soil, the author determined the quantities of nitrates present in the water of the Seine at three different points, in the water of its chief tributaries, and in the spring waters supplied to Paris. The determinations were made during the past severe winter, after the temperature had been below 0° for some weeks, and under these conditions it may be assumed that there was no surface drainage, and that the activity of aquatic vegetation of all kinds was so reduced that its influence on the quantity of nitrates may be neglected. The results in milligrams of nitrogen per litre are as follows.

Water of the Seine.

	Paris.				Montereau.		Charenton.	
Feb.	9th.	13th.	19th.	23rd.	16th.	17th.	15th.	28th.
	2·09	2·31	2·25	2·26	1·99	2·08	2·55	2·75

The Marne at Charenton gave 2·34 on February 14 and 2·02 on February 28 the Yonne at Montereau, 2·21 on February 16 and 2·52 on February 27; the Oise at Pontoise, 2·78 on February 19 and 2·43 on March 1; whilst the spring waters from Vanne, Dhuis, and Avre gave 2·61, 2·86, and 3·08 respectively.

The constancy of the proportion of nitrates in the Seine and its tributaries from February 14 to February 28 is remarkable, and this proportion remained constant in spite of the considerable diminution in the quantities of water flowing down the rivers.

Calculating on the basis of the volume of water flowing down the rivers, and allowing for the fact that part of the basin of the Seine is occupied by woods, meadows, moors, &c., it is found that the loss of nitrogen per hectare is 4·2 kilos. if the layer of infiltrated water is taken as one-sixth of 700 mm. (the mean rainfall), 6·44 kilos. if it is taken as one-fourth of 700 mm., and 8·48 kilos. if it is taken as one-third of 700 mm. These losses are much smaller than has hitherto been supposed, and it is noteworthy that the loss will be smallest in poor soils, and highest in rich soils, in which the high proportion of organic matter and the activity of nitrification will soon make up the loss. C. H. B.

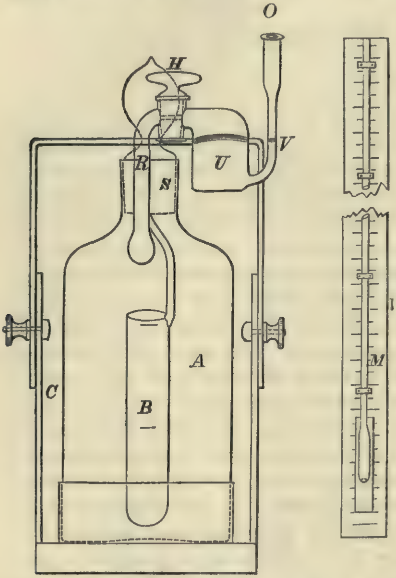
Analytical Chemistry.

Universal Gas Volumeter. By Georg Lunge (*Bull. Soc. Chim.*, 1894, [3], **11**, 625—650).—A self-correcting modification of the well-known nitrometer. The gas to be measured is in most cases generated or treated in a separate vessel, and transferred to the measuring apparatus. This consists of three vertical tubes, which can be moved up and down independently, and are connected at the lower ends by flexible tubing. The graduated measuring tube communicates through a two-way tap with the generating and absorption vessels, and is enlarged by a bulb at the middle; the second tube is open at the top, and serves to regulate the pressure of the gas; the third, or reduction tube, is filled with an amount of air which, if dry, would occupy 100 c.c. at the standard temperature and pressure. When the mercury is at the same level in the measuring and reduction tubes, and the air in the latter occupies 100 c.c., the gas in the measuring tube occupies the volume it would occupy when dry at the standard temperature and pressure. By suitably altering the amount of air in the reduction tube, any desired set of readings may be made in the measuring tube, as, for instance, the weight of a particular gas. Means are provided for introducing a drop of water or sulphuric acid into the measuring tube.

The apparatus is applicable to all purposes for which the nitrometer is available. In estimating the value of bleaching powder, manganese dioxide, and permanganate, advantage is taken of the ready way in which these substances liberate oxygen from hydrogen peroxide. The nitrogen of ammonia and of carbamide is liberated as such by alkaline hypobromite. Carbonic anhydride in carbonates may be liberated in the generating vessel, and expelled into the measuring tube by hydrogen generated from aluminium in the same vessel, the amount being measured by absorption with alkali. Carbon in iron is estimated in the same way, the iron being first dissolved by copper sulphate, and the resulting mixture of copper and carbon oxidised with chromic acid. Different forms of generating vessels are described for these various purposes.

The measuring tube may be connected with a V. Meyer vapour density apparatus, and the density determinations can then be made under reduced pressure. The apparatus may also be used as a barometer. Jn. W.

The Gasgravimeter. By Guido Bodländer (*Zeit. angw. Chem.*, 1895, 49—55).—The apparatus differs from the author's gasbaroscope by its simpler construction and manipulation; also by the very small quantity of mercury required. It is suited for a large number of analyses, such as the estimation of carbonates by means of acids, and of acids by means of calcium carbonate, the valuation of zinc dust by means of hydrochloric acid, the estimation of urea by alkaline hypobromite, &c., in fact in all analyses where it is not necessary to apply heat, and where no nitric oxide is being evolved.



The gasgravimeter (see illustration) consists of a 500 c.c. flask *A*, with which is connected the ⋃-tube *UV* by means of the side tube *R* and stop-cock *H*. To the glass stopper *S*, which is closely ground in the neck of the flask, is sealed a 20—50 c.c. graduated beaker *B*. One arm *U* of the ⋃-tube is closed on the top, and has a diameter of 20 mm. and an equal height; the other arm *V* has a diameter of 2 mm., and to its opening *O* is ground a tube *V′*, 50 cm. in length and 2 mm. in diameter, open at both ends. *V* has a mark at 1—2 cm. from the bend. *V′* is attached to an empirical or calculated scale *M* in such a manner that the zero of the scale corresponds with the mark on *V* when *V′* is put on *V*. The apparatus is fixed in a support *C* in such a manner that when pressure occurs in *A* the stopper cannot possibly blow out.

When the apparatus is wanted for analysis, mercury is poured through *O* into the ⋃-tube until its top in *V* corresponds with the mark on *V* when both arms of the ⋃-tube are under the same pressure. The solid or liquid substance to be tested is now put in weighed or measured quantity on the bottom of *A*, and into the beaker *B* is put an excess of the decomposing reagent. The well greased stopper is now put on to the flask, which is then fixed in the support *M;* the stop-cock *H* is removed, and the apparatus is put into a large trough holding water of the temperature of the laboratory. After a few minutes the stop-cock *H* is put in so as to cut off the contents of the flask, the opening *O* is closed to prevent loss of mercury during the shaking, and by inclining the apparatus the reagent is allowed to run on to the sample. After the action has finished, the apparatus is again placed in the trough, the stopper from *O* is removed, and the tube *V′* placed on *V*. By cautiously turning the stop-cock *H* the extra gas pressure is gradually spread through *U*, and the mercury gradually rises in *V* and *V′*. The level of the mercury in *V* or *V′* is read off on the scale.

The quantity of gas evolved is proportional to the pressure of the mercury column in V and V', and may be directly ascertained without consulting the barometer by a simple calculation. L. DE K.

Potassium Hydrogen Tartrate as Material for Standardising Alkalis. By ARTHUR BORNTRÄGER (*Zeit. anal. Chem.*, 1894, **33**, 713—714).—The proposal of the author (Abstr., 1892, 525; 1893, ii, 144) and others to make pure potassium hydrogen tartrate the starting point for preparing standard alkalis was, as well as his method of purifying the salt (*loc. cit.*), adopted at a conference of the directors of Italian agricultural experimental stations held at Modena on December 27—28, 1893. M. J. S.

Estimation of Bromine in Presence of Chlorine. By WILHELM WENSE (*Zeit. angw. Chem.*, 1895, 13—14).—The author recommends the following process for estimating small quantities of bromine in brines. The solution is mixed with a slight excess of chlorine water, and distilled into a solution of potassium iodide of known strength. When all the bromine has distilled over, this solution is made up to a convenient bulk, and the liberated iodine is titrated in an aliquot part by means of sodium thiosulphate. Another portion is carefully evaporated in a tared dish, dried at 160—180°, and weighed. The process is based on the fact that 1 milligram of bromine acting on an iodide causes a loss in weight of 0·5866 milligram, whilst 1 milligram of chlorine causes a loss of 2·5773 milligrams. If now T represents the amount of liberated iodine, and D the loss in weight of the potassium iodide, c the amount of chlorine, and b the amount of bromine in the sample, the calculation will be

$$1.\ \mathrm{T} = c + b + \mathrm{D}.$$
$$2.\ \mathrm{D} = 0{\cdot}5866\,b + 2{\cdot}5773\,c.$$

or

$$c = 0{\cdot}797\,\mathrm{D} - 0{\cdot}295\,\mathrm{T}.$$
$$b = 1{\cdot}295\,\mathrm{T} - 1{\cdot}797\,\mathrm{D}.$$

The test analyses are satisfactory. L. DE K.

Colorometric Estimation of Hydrogen Sulphide. By A. C. HUYSSE (*Chem. Centr.*, 1894, ii, 108; from *Nederl. Tydschr. Pharm.*, **6**, 167—171).—The method depends on the formation of methylene blue. One c.c. of hydrochloric acid (30 per cent.), four drops of paramidodimethylaniline hydrochloride solution (2 per cent.), and five drops of ferric chloride solution (0·5 per cent.) are added to 50 c.c. of the solution containing the hydrogen sulphide. The limits of applicability of the process are 0·48 milligram and 0·01 milligram of hydrogen sulphide per 100 c.c. of water; hence it is serviceable in the examination of natural waters. A. G. B.

Estimation of Tellurium in Copper Bullion. By CABELL WHITEHEAD (*J. Amer. Chem. Soc.*, 1895, **17**, 280—281).—Twenty to fifty grams of the bullion is dissolved in nitric acid (sp. gr. 1·286) and the excess of acid is then boiled off. To the solution is added a solution of ferric nitrate, equivalent to 0·25 gram of iron. The hot solution is precipitated with excess of ammonia, and the precipitate is washed with dilute ammonia until free from copper; redissolving and reprecipitating if necessary. The precipitate which contains the tellurium and selenium as ferric compounds is dissolved in hydrochloric acid, mixed with excess of tartaric acid, and rendered alkaline with aqueous potash; on passing hydrogen sulphide, the tellurium and selenium dissolve as double sulphides. They are then precipitated from their alkaline solution by means of hydrochloric acid, and redissolved in nitro-hydrochloric acid. The solution is evaporated to dryness; the residue is dissolved in hydrochloric acid and then precipitated by a current of sulphurous anhydride. After first weighing the joint tellurium and selenium on a filter, the latter is extracted by boiling with concentrated solution of potassium cyanide and then reprecipitated by addition of hydrochloric acid. The filtrate contains a small amount of tellurium, which may be recovered by precipitating with sulphurous acid.

L. DE K.

Kjeldahl's Method and Platinochlorides. By MARCEL DELÉPINE (*Compt. rend.*, 1895, **120**, 152—153).—Trimethylamine platinochloride, when subjected to Kjeldahl's process, gave only 3·88 per cent. of nitrogen instead of 5·15; and ammonium platinochloride gave only 1·89 per cent. instead of 6·26. This loss of nitrogen is in all probability due to the action of the chlorine of the platinochloride on the ammonia or the amine, the nitrogen being liberated.

C. H. B.

Volumetric Estimation of the Soluble Phosphoric Acid in Superphosphates. By WILHELM KALMANN and K. MEISSELS (*Zeit. anal. Chem.*, 1894, **33**, 764—766; from *Mitt. tech. Gewerbemuseums*, Wien, 1894).—Twenty grams of the superphosphate is dissolved to one litre. (*a*) 100 c.c. of the filtered solution, coloured with methyl-orange, is accurately neutralised with seminormal alkali. Phenolphthaleïn is then added, and the amount of alkali required to produce the pink colour is noted. (*b*) 100 c.c. of the solution is mixed in a 250-c.c. flask with a moderate excess of seminormal alkali, made up, shaken, and filtered from the precipitated tricalcium phosphate. One hundred c.c. of the filtrate is mixed with phenolphthaleïn and neutralised with seminormal acid. Methyl-orange is then added, and the amount of acid required to produce the change of colour is ascertained. Titration (*b*) gives a result which is exactly as much too low as that of (*a*) is too high. The arithmetical mean, multiplied by 0·0355, gives the amount of phosphoric anhydride in 2 grams of the substance. The results agree closely with those of the citrate method.

M. J. S.

Analytical Communications. By FR. SCHEIDING (*Zeit. angw. Chem.*, 1895, 79—81).—*Sources of error in alkalimetry.*—The author has proved by a series of experiments that the excess of normal soda often required to neutralise a known quantity of acid is solely due to the presence of carbonic anhydride. In titrating with phenolphthaleïn as indicator, the apparently neutralised solution should be again acidified with about 0·2 c.c. of standard acid, boiled for 10 minutes, and then again be titrated with the alkali. As regards methyl-orange, the author states that this indicator is indifferent to small quantities of carbonic anhydride but is slightly affected by large amounts. The notion that it can only be used in cold liquids is erroneous, as it acts quite as well in hot solutions.

Estimation of phosphoric acid.—The precipitate obtained in the *citrate* method generally gives, on ignition, a black mass. The author advises moistening it with solution of ammonium nitrate, when a snow white residue will be finally obtained. When bone-meal is digested with sulphuric acid to dissolve out the phosphoric acid and also the nitrogenous matter, an insoluble residue is left which, as a rule, is not filtered off but introduced into the measuring flask. The author has found that when using 5 grams of the sample the insoluble residue may be taken to occupy 1·5 c.c., and in accurate analysis allowance should be made for this.

Reduction of ferric salts by means of zinc, prior to titrating with permanganate.—The iron solution should be very dilute, containing no more than 0·15 gram of iron per 250 c.c. Not less than 20 grams of zinc and 30—50 c.c. of sulphuric acid should be added, and after this has been acting for 5—6 hours the whole should be boiled, with exclusion of the air. If these precautions are not taken, the results will be quite untrustworthy. L. DE K.

Estimation of Sulphur in Pyrites. By GEORG LUNGE (*Zeit. angw. Chem.*, 1895, 69—73).—The author's method consists in treating the sample with nitro-hydrochloric acid and precipitating the sulphuric acid with barium chloride, after having first removed the iron by precipitating with ammonia. Gladding has stated that it is better to oxidise the ore with bromine and nitric acid, and also that the ferric hydroxide retains sulphuric acid which must afterwards be estimated by barium chloride.

The author states that his original nitro-hydrochloric acid method is better than the bromine process; also that when working according to his directions, no sulphuric acid is retained by the iron precipitate (compare Abstr., 1893, ii, 187). L. DE K.

Estimation of Zinc. By PORTER W. SHIMER (*J. Amer. Chem. Soc.*, 1895, **17**, [4], 310—312).—About 0·8 gram of zinc ore is dissolved in hydrochloric acid; but as any insoluble residue may still contain *spinel*, it must be examined separately by fusion. The acid solution is evaporated to dryness, the residue redissolved in nitric acid (sp. gr. 1·2), again evaporated to moist dryness, 100 c.c. of strong nitric acid added, and the manganese precipitated by means of potassium chlorate. The liquid, after being filtered through asbestos and the precipitate washed, first with nitric acid and then with water, is evaporated to dryness, taken up with hydrochloric acid and again evaporated to dryness. After dissolving in water, the usual double basic acetate precipitation is made. The zinc is first precipitated by a current of hydrogen sulphide, and after being redissolved in hydrochloric acid is precipitated as zinc ammonium phosphate, which is finally ignited and weighed as zinc pyrophosphate. L. DE K.

Chemical Investigation of Steel. By LEOPOLD SCHNEIDER (*Chem. Centr.*, 1894, ii, 112—113; from *Österr. Zeit. Berg. u. Hüttenwesen*, **42**, 241—244; compare Abstr., 1893, ii, 392).—*To estimate the carbide-carbon in steel*, 2 grams of the steel is dissolved in 100 c.c. of dilute sulphuric acid (1 : 10) with exclusion of air; the residue is filtered, and the carbon in it is burnt in the usual manner. *To estimate the total carbon*, the sample is dissolved in sodium cupric chloride solution in the usual way, the author preferring to prepare the solution by boiling 1 kilo. of cupric sulphate with $\frac{3}{4}$ kilo. of sodium chloride in 2 litres of water, and decanting the boiling hot solution from the separated sodium sulphate; the cooled liquid is ready for use.

It is impossible to directly burn the carbon in a steel because of the protective layer of iron oxide which forms on the metal. But if a mixture of powdered iron, powdered lead, and powdered copper be heated to a low redness, and oxygen be passed over the mixture, the lead and copper burn and effect the complete oxidation of the iron. Lead powder is obtained by shaking molten lead until it is cold; copper powder is prepared by heating fine copper wire and reducing the oxide in hydrogen, the product being afterwards easily powdered; the two powders are mixed in the proportion of three of lead to one of copper. The steel can be obtained in sufficiently small particles by the prolonged hammering of the borings in a steel mortar; the very thin plates thus obtained will burn equally as well as powdered iron. Three grams of the finely-divided steel are mixed with 10 grams of the copper-lead mixture, and disposed in a porcelain boat, which rests on a mat of ignited asbestos in a combustion tube. The front part of the tube contains a column of copper oxide some 10—20 cm. long, and the combustion is effected in the usual manner in oxygen. A blank experiment with the copper-lead mixture is necessary. The results are from 0·01 to 0·2, average 0·04, per cent. higher than those yielded by the sodium cupric chloride method.

It is noted that in the process of subdividing the steel mentioned above, a portion of the material falls to very fine powder at the beginning of the hammering, but that this tendency rapidly diminishes as the hammering is continued. The proportion between spangles and powder obtained from various specimens has been approximately determined, since it must have some connection with the tenacity of the sample. The following figures give the percentage proportion of spangles to powder. Nickel-steel, 99 : 1; Krupp's tool steel, 98 : 2; crude puddled steel, 94 : 6; chrome-steel, 90 : 10; rolled steel, 78 : 22; Martin ingot iron, 69 : 32 and 68 : 40; puddled steel, 66 : 34; crucible cast steel, 32 : 68; tungsten-steel, 5 : 95; Mushet steel, 0 : 100. A. G. B.

Barium Hydroxide Solution in Steel Analysis. By JAMES O. HANDY (*J. Amer. Chem. Soc.*, 1895, **17**, 247—251).—When estimating carbon in steel, the author prefers passing the dried products of combustion through a 2 per cent. solution of barium hydroxide. The absorption apparatus consists of two tubes, each consisting of a long, slanting tube connected at both ends with a bulb. The precipitated barium carbonate may be collected and weighed, and in this case a current of air free from carbonic anhydride is passed over the surface of the liquid so as to prevent the formation of a film of carbonate during the filtration. Or the excess of barium hydroxide may be titrated, best with standard sulphuric acid, as in Pettenkofer's method of air analysis. L. DE K.

Estimation of Free Ferric Oxide in Soil. By ROBERT SACHSSE and ARTHUR BECKER (*Landw. Versuchs-Stat.*, 1895, **45**, 419—422).—The process consists in first converting the ferric oxide into sulphide, and this, by means of potassium cyanide, into potassium ferrocyanide. The substance is mixed with water (about 100 c.c.), treated with potassium cyanide (3 grams) and with hydrogen sulphide for an hour. The excess of hydrogen sulphide is expelled by heating on a water-bath, after which the whole is filtered. The filtrate is strongly acidified with sulphuric acid, evaporated to dryness, and ignited. The residue is redissolved and titrated, as usual, with permanganate.

With precipitated ferric hydroxide mixed with kaolin, very good results were obtained, but with the natural crystalline oxides the results were less satisfactory. In the case of brown hæmatite not much more than half was dissolved, and lepidokrokite behaved similarly; a single sample of göthite gave three different results. The incomplete solution is due to the fact that crystalline ferric hydroxide is scarcely converted into sulphide by hydrogen sulphide. Experiments, in which precipitated ferric hydroxide was treated with hydrogen sulphide at the ordinary temperature and at 100°, showed an increase of weight corresponding nearly with, or even exceeding, that required by FeS_2; in one case (at 100°), the product had almost exactly the weight corresponding with the formation of Fe_2S_3,H_2S. Göthite, when similarly treated, scarcely increased in weight at all, whilst brown hæmatite behaved like a mixture of amorphous and crystalline ferric oxide (compare Abstr., 1893, ii, 243).

N. H. J. M.

Estimation of Iron and Aluminium in Phosphates. By K. P. MCELROY (*J. Amer. Chem. Soc.*, 1895, **17**, 260—263).—The method given by Ogilvie (wrongly known as the McElroy process) consists in neutralising the filtrate from the molybdic precipitate with ammonia. The iron and aluminium precipitate is redissolved in acid and reprecipitated by ammonia, washed, dried, and weighed. The author has obtained good results by this method, but of late has become convinced that the process is untrustworthy. L. DE K.

Separation of Nickel from Iron. By EDWARD D. CAMPBELL and W. H. ANDREWS (*Amer. Chem. J.*, 1895, **17**, 164—167).—The mixed metals are dissolved in nitric acid, which is used to the extent of 20—25 c.c. in excess, and a solution of sodium pyrophosphate (13 grams to each gram of metal) in warm water is added. The precipitated ferric pyrophosphate is then just dissolved by adding a moderately strong solution of sodium carbonate until the liquid has a dull olive-green colour. If excess of the carbonate be employed, the subsequent precipitation of the nickel will be incomplete. The solution is filtered through asbestos into a flask, and the nickel precipitated as xanthate by adding a fresh cold concentrated solution of potassium xanthate. The flask is stoppered, and shaken intermittently for 10 minutes to complete the precipitation. The xanthate is filtered through asbestos, washed with a 1 per cent. solution of potassium xanthate, and dissolved in nitric acid (1 : 1) freshly diluted. Dilute sulphuric acid (2 c.c.) is then added, and the solution boiled down until fumes of sulphuric acid are evolved. The residue is dissolved in water, and the iron precipitated by a small excess of ammonia; the ferric hydroxide must be redissolved and reprecipitated; it seldom exceeds 0·003 gram. The ammoniacal solution is transferred to a large platinum dish (200 c.c.), a solution of disodium hydrogen phosphate (3 grams) is added, together with 25 c.c. of strong ammonia, and the nickel is deposited electrolytically by a current of 0·14 ampère per 100 sq. cm. of the dish, for 12 hours. An alternative method is to titrate the slightly ammoniacal filtrate from the ferric hydroxide with a standard solution of potassium cyanide, using silver nitrate, followed by potassium iodide, as an indicator; the suspended silver iodide will only dissolve when all the nickel has been converted into potassium nickel cyanide.

A. G. B.

Estimation of Chromium in Chrome Ore. By Edmund Clark (*J. Amer. Chem. Soc.*, 1895, **17**, 327—330).—0·5 gram of the finely-ground sample is weighed into a 50-c.c. platinum crucible, covered with 25 grams of potassium hydrogen sulphate, and fused over a Bunsen burner protected from draughts; the heat being gradually increased to prevent sputtering, and finally kept at a moderate red heat for 40 minutes. The contents are poured into a platinum dish, and, when cold, boiled with 35 c.c. of hydrochloric acid and 25 c.c. of water; the liquid is then introduced into a beaker, into which has been placed the crucible and its cover, to dissolve the remainder of the sulphates. After settling, the clear liquid is decanted, and the residue treated with another 15 c.c. of acid; finally, the liquid is filtered, ammonia added in slight excess, and the mixture heated until the odour of ammonia is scarcely perceptible. The precipitate, freed from lime and magnesia by redissolving it in hydrochloric acid and reprecipitating with ammonia, is dissolved in 50 c.c. nitric acid (sp. gr. 1·42), heated over a Bunsen flame, and from time to time *small* quantities of potassium chlorate are added, the gradual oxidation being accompanied by a change of the green colour to a clear orange-red; a little more chlorate is added to insure complete oxidation. The iron and alumina are now separated from the chromic acid by means of ammonia, but to render this complete, the precipitate must be redissolved in nitric acid and reprecipitated by ammonia; the united ammoniacal filtrates contain all the chromic acid, from which it may be easily precipitated as chromic hydroxide by adding hydrochloric and sulphurous acids and then ammonia. Or the liquid may be acidified with acetic acid, precipitated by lead acetate, and the chromium weighed as lead chromate. The process admits of the accurate estimation of the iron and other impurities in the ore.

L. DE K.

Assay of Alloys containing Gold, Silver, Zinc, and Tin. By RICHARD OEHMICHEN (*Zeit. angw. Chem.*, 1895, 133).—The author has tabulated the results of 22 experiments, showing that the direct cupellation of these alloys gives results considerably below the truth.

L. DE K.

Improved Methods of Water Analysis. By IRVING A. BACHMAN (*J. Amer. Chem. Soc.*, 1895, **17**, 296—303).—The author has noticed that, when using the albuminoïd ammonia process, the evolution of ammonia is often increased as the liquid in the retort becomes more concentrated. Acting on this observation, the new apparatus is so arranged that the 50 c.c. permanganate solution acts on 50 c.c. of water only, and when 30—40 c.c. has distilled over, the remaining 250 c.c. of water is allowed to run in at the same rate as the distillation is proceeding, which must not exceed 15 c.c. in 15 minutes. The distillation is stopped when 250—300 c.c. has passed over. Before adding the permanganate, the water (500 c.c.) is, of course, freed from saline ammonia by distilling with sodium carbonate until 300 c.c. is left.

The apparatus consists of a distilling flask connected with two burettes with stop-cocks, the smaller one of which admits the solution of sodium carbonate and afterwards the permanganate, whilst the larger one serves to draw up the water after the free ammonia has passed over. The cooling apparatus is a closely coiled glass worm, with a long projection at the lower extremity, to which is attached a vessel by a soft rubber stopper, which is in turn connected with a nitrogen bulb filled with Nessler solution. By means of an air-pump, a partial vacuum may be established. The distilling flask is heated in a brine bath. If the directions are properly adhered to, the condensation will be very complete, and no discoloration will be noticeable in the Nessler solution.

The author has obtained good results with the organic carbon process, but prefers to evaporate the water in a vacuum, to avoid the objectionable features of open-air evaporation. L. DE K.

Composition of American Peppermint Oil. By FREDERICK B. POWER and CLEMENS KLEBER (*Zeit. anal. Chem.*, 1894, **33**, 762—763). —The oil prepared by the authors from the fresh plant contains acetaldehyde, valeraldehyde, acetic acid, isovaleric acid, pinene (inactive ?), phellandrene, lævolimonene, cineole, menthone, menthol, menthylic acetate, menthylic isovalerate, the menthylic salt of an acid $C_8H_{12}O_2$, a lactone, and cadinene.

To estimate the menthol and menthone, 20 grams of the oil is freed from the ethereal salts by cohobating with 30 c.c. of normal alcoholic soda for an hour, after which the unconsumed soda is titrated by normal acid (using phenolphthaleïn). The well washed oil is then acetylated by boiling for an hour with an equal volume of acetic anhydride and 2 grams of anhydrous sodium acetate in a reflux apparatus. The product is washed with water and dilute soda, dried with calcium chloride, and filtered. Using 8—10 grams, the saponification number of this acetylated product is then determined, and the menthol calculated therefrom. Since 1 c.c. of normal soda corresponds with 0·156 gram of menthol, or 0·198 gram of menthylic acetate, for every 1 c.c. of soda consumed, the difference, 0·042 gram, must be subtracted from the weight of acetylated substance employed, in order to calculate the percentage of menthol in the unacetylated oil.

For estimating the menthone, a portion of the oil freed from ethereal salts is dissolved in twice its volume of alcohol and boiled with sodium. The oil is then precipitated by water; one half of it is used for a menthol estimation, and the menthone is calculated from the excess of menthol found. The other half is again treated with sodium to ascertain whether the reduction of the menthone had been complete.

The sp. gr. of the oil ranges from 0·905 to 0·916; the specific rotatory power from −25° to −35°. The menthol present as ethereal salts varies from 3·45 to 14·12 per cent.; the free menthol from 24·2 to 72·7 per cent.; normal American oil containing 40—50 per cent. Mitcham oil, and especially Japanese oil, are richer in menthol than American. In a specimen containing 54·5 per cent. of menthol (total), 12·3 per cent. of menthone was found.

M. J. S.

Detection and Estimation of Alkyl Groups attached to Nitrogen. By JOSEF HERZIG and HANS MEYER (*Monatsh.*, 1894, **15**, 613—626; compare Abstr., 1894, ii, 219).—The authors have carefully examined the method previously proposed (*loc. cit.*) for the estimation of alkyl groups attached to nitrogen, and, for the purpose, employ special apparatus, which they fully describe. The method, which depends on the fact that, when heated, the hydriodides of certain bases which contain alkyl groups attached to nitrogen yield the base and an alkylic iodide, can obviously be employed only for those substances which form hydriodides. In almost every case the expected results were obtained, but methylphenylhydrazine persistently gave a methyl number only half of that corresponding with its accepted constitution, whilst no methyl group could be recognised in sparteine and only one alkyl group was obtained from pilocarpin.

G. T. M.

Influence of the Lead Acetates on the Estimation of Invert Sugar. By ARTHUR BORNTRAEGER (*Zeit. angw. Chem.*, 1895, 103—104).—The author has stated, two years ago, that large quantities of lead acetate or basic acetate interfere with the accurate estimation of invert sugar by the Fehling-Soxhlet process. Small quantities of these salts are, however, harmless.

The matter has been investigated by Edson, and also by Weld, but their method of working does not admit of comparison with the author's process.

L. DE K.

Estimation of Cane Sugar in the Presence of Commercial Glucose. By H. A. WEBER and WILLIAM MCPHERSON (*J. Amer. Chem. Soc.*, 1895, **17**, 312—320).—The process used by the authors consisted in taking the sp. gr., specific rotatory power, copper reducing power, and ash. They come to the following conclusions. 1. An error is introduced in the cane-sugar estimation by the presence of dextrin in commercial glucose, as this also undergoes a slight hydrolysis during the inversion of the sugar by acids. 2. That this error, however, may be reduced to a minimum if the inversion of the cane sugar is effected by heating for 10 minutes only, the temperature being gradually raised so as to reach 68° at the expiration of this time. 3. That the results with different glucoses are sufficiently uniform to warrant the introduction of a correction for the mean error. 4. That analysts should strictly adhere to one method of inversion. L. DE K.

Action of Acetic and Hydrochloric acids on Cane Sugar. By H. A. WEBER and WILLIAM MCPHERSON (*J. Amer. Chem. Soc.*, 1895, **17**, 320—327).—The authors have found that when hydrochloric acid is used for the inversion of cane sugar, the polariscopic reading is 1·4° too high, whilst, if acetic acid is used, the error is only 0 2°. This explains why it was formerly thought that acetic acid never caused complete inversion. Acetic acid, although acting very slowly, is preferable to hydrochloric acid, particularly when the sample contains dextrin, as it does not act on the latter.

L. DE K.

Reaction of Hydroxycarboxylic acids. By ARMAND BERG (*Bull. Soc. Chim.*, 1894, [3], **11**, 882—883).—Uffelman's reagent for lactic acid, namely, extremely dilute ferric chloride coloured amethyst by phenol, is more sensitive without the latter, and is of general application. The reagent should be slightly acid, the best proportions being two drops of ferric chloride solution and two drops of hydrochloric acid to 100 c.c. of water. An intense yellow colour is produced with the following α- and β-hydroxy-acids, but not with methoxy- or ethoxy-isobutyric acids: — Malic, tartaric, citric, glycollic, lactic, α-hydroxyisobutyric, glyceric, gluconic, mucic, phenylglycollic, and hydracrylic acids. JN. W.

Estimation of Salicylic acid and Salicylates. By LEONCE BARTHE (*Bull. Soc. Chim.*, 1894, [3], **11**, 516—522).—The method described is applicable to the salicylates and benzoates of the alkalis, as well as to the salicylates of the alkaline earths and certain of the heavy metals, and is based on the non-volatility of salicylic acid with aqueous vapour at 50—60°.

Sodium salicylate, for instance (1·6 grams = 1/100 gram-molecules), is dissolved in hydrochloric acid (2 c.c.) and water (20 c.c.), and the solution evaporated to dryness at 50—60°; the residue of salicylic acid and sodium chloride is then taken up with boiling water (50—60 c.c.), and titrated with alkali in presence of phenolphthaleïn. The amount of normal alkali in cubic centimetres multiplied by 10 gives the percentage of pure salt. The metal can be indirectly estimated in the same portion by titrating the chlorine with silver nitrate in presence of a chromate after the alkaline phenolphthaleïn has been decolorised with nitric acid. Ammonium salicylate requires litmus, but the ammonia can be determined by the same indirect process in a separate portion. The acid may be estimated in manganese and bismuth salicylates after removing the base by means of sodium carbonate; the base, as oxide, by igniting the salt with ammonium nitrate. Mercuric salicylate is dissolved in potash, the solution acidified with hydrochloric acid, and evaporated to dryness at 40—45°; the residue of salicylic acid and mercuric chloride is then dissolved in a known excess of aqueous potassium iodide, and the acid titrated in presence of phenolphthaleïn. The mercury is estimated by titrating the excess of iodide with mercuric chloride.

The solubility of the various salicylates may be determined by estimating the acid in the saturated solution; that of the magnesium salt is 0·8015 gram per 100 c.c.; that of the strontium salt 1·830. Basic strontium salicylate, $C_7H_4O_3Sr + 2H_2O$, appears to be dissociated in solution into the normal salicylate and free alkali.

JN. W.

Gaseous Products in Milk. By WILHELM THÖRNER (*Chem. Zeit.*, 1894, **18**, 1845—1848).—The author has estimated the amount of gaseous matters contained in a large number of milks of different age and composition, and tabulated the results. It appears that separated milk only retains 27—54 c.c. of gas per litre, whilst the fresh article generally has from 57 to 86 c.c., the deficiency being chiefly caused by loss of carbonic anhydride. Five or ten minutes' boiling is not sufficient to expel all the gases, the amount retained being 15—19 c.c. per litre.

The author states that the well-known taste of boiled milk is chiefly due to the great loss of gas, mostly carbonic acid, and that the original taste may be restored by cautious introduction of sterilised carbonic anhydride mixed with air. L. DE K.

New Process for Estimating Fat in Milk. By P. FERNANDEZ-KRUG and WILHELM HAMPE (*Zeit. angw. Chem.*, 1894, 683—687, 709—710).—Five c.c. of milk is slowly dropped from an accurate pipette on to 7·5 grams of elutriated and ignited kaolin contained in a 200-c.c. nickel basin. After thoroughly mixing, 5 grams of powdered anhydrous sodium sulphate is added, and everything is again carefully mixed; the mass soon gets dry without application of heat, and is then introduced, by means of a nickel funnel and a little brush, into a 100-c.c. flask, which is fitted with a glass stopper or a clean cork. Twenty-five c.c. of pure ether is delivered from an accurate pipette, and the mixture is shaken for five minutes; after settling, 5 c.c. of the clear liquid is pipetted off, put into a 12-c.c. weighed glass flask, the flask placed on a hot metallic plate, and the vapour ignited; the last traces of ether are removed by a gentle blast, and the pure fat is then weighed. This method gives excellent results, as proved by numerous test experiments.

For the benefit of those who do not care to use an ordinary chemical balance, the authors have constructed a balance of the Westphal type, which allows the direct reading off of the percentage of fat. L. DE K.

Estimation of Fat in Milk. By CARL BOETTINGER (*Chem. Zeit.*, 1894, **18**, 1660).—The author introduces 6 c.c. of the sample of milk into a so-called butter-tester divided to 0·2 c.c., adds 1·2 grams of ignited amorphous silica, and shakes vigorously for five minutes. The milk begins to coagulate after two or three minutes. The tube is now cautiously heated with a small flame for about one minute, when the liquid butter fat neatly separates, and may be measured.

The fat may also be dissolved in ether and afterwards weighed.

L. DE K.

Effect on Butter of Feeding with Sesame and Cotton Cakes. By V. STEIN (*Bied. Centr.*, 1895, **24**, 93—94; from *Tidskr. f. Landökon.*, 1894, **13**, 664).—Butter examined during prolonged feeding with sesame cake gave negative results when tested for Baudonin's (? Baudouin) and Becchi's reactions. The substance in sesame oil which shows Baudonin's reaction does not therefore pass into the milk even when an unusually large amount of sesame cake is given to cows. Similar experiments made with cotton cake shows that the substance which shows the Becchi reaction passes into the milk and butter. Whilst therefore a sesame oil reaction in butter would indicate adulteration with margarine containing sesame oil, Becchi's reaction would not necessarily prove the presence of margarine containing cotton-seed oil. N. H. J. M.

Urea in the Blood. By CH. EUGÈNE QUINQUAUD (*Compt. rend. soc. Biol.*, 1893, 952—956).—Most previous methods for estimating the amount of urea in the blood involve the evaporation of alcoholic extracts of the blood in the water bath. This, however, leads to a partial decomposition of the urea, the loss being stated to be from 10 to 30 per cent. The temperature should not be raised above 35°, and concentration is best carried out in a vacuum; an apparatus, by means of which this can be easily accomplished, is described.

W. D. H.

Solubility of Quinine in Alkalis. By EMMANUEL DOUMER and E. DERAUX (*J. Pharm.*, 1895, [6], **1**, 50—59).—The authors determined the solubility by gradually adding a 1 per cent. solution of sulphate of quinine to a known quantity of the alkali of known strength, and observing the point at which a permanent precipitate was formed. Detailed tables of the results are given.

Ammonia.—The actual amount of quinine dissolved by 100 c.c. of ammonia increased from 0·042 gram by a 0·26 per cent. solution to 0·092 by a 17·9 per cent. solution; but, reckoned per gram of ammonia, these results decrease from 0·163 gram for the weaker solutions to 0·006 gram for the stronger. For complete precipitation of the quinine, the smallest possible quantity of ammonia should therefore be employed.

Soda.—The quinine dissolved by 100 c.c. of soda ranged from 0·046 gram by a 0·0035 per cent. solution to 0·0075 gram by a 8·54 per cent. solution, or, per gram of soda, from 13·14 grams to 0·001 gram.

Potash.—The quinine dissolved by 100 c.c. of solution decreased from 0·044 gram by a 0·306 per cent. solution to 0·003 gram by a

22·3 per cent. solution, or from 0·144 to 0·0001 gram per gram of potash.

Influence of Alkali Carbonates.—The presence of an alkali carbonate in the alkaline solution greatly diminishes its solvent power for quinine, and it is possible that the numbers given for potash and soda are lower than they should be, owing to the presence of carbonate as an impurity. Ammonium carbonate largely increases the solvent power of potash and soda (probably owing to the formation of free ammonia), but decreases that of ammonia.

For complete precipitation of quinine by the fixed alkalis, a considerable quantity of alkali of high concentration should therefore be used, and it is advisable for the alkaline solution to contain carbonate.

L. T. T.

Detection of Colchicine. By Ernest Barillot (*Bull. Soc. Chim.*, 1894, [3], **11**, 514—516).—To detect colchicine, the suspected alkaloïd in the form of the free base is heated with oxalic acid (0·25 gram) and concentrated sulphuric acid (1 c.c.) for an hour at 120°, and the product is diluted with water. If colchicine is present, the colour is yellow before the heating and reddish-brown afterwards, and is not affected by the dilution with water. Excess of alcoholic soda is now added, followed by excess of acetic acid, and the acid solution is extracted with chloroform; if colchicine were originally present, the chloroform extract would contain a yellow colouring matter, which, when dried, yields a violet-red coloration with concentrated nitric acid, and a raspberry-red with concentrated sulphuric acid. If the colouring matter is not entirely taken up by the chloroform, but floats about in flakes, it may be collected on a very small filter, and the dried strips of the latter immersed in the acids.

Ptomaïnes give no reaction under this treatment. Morphine and codeïne also yield coloured products, but these are quite distinct. The test is practicable even with $\frac{1}{6}$ milligram of colchicine.

Jn. W.

Fibrinolysis. By A. Dastre (*Compt. rend. soc. Biol.*, 1893, 995—997).—In estimating fibrin in blood or similar liquids, it is necessary to observe four conditions: (1) to agitate the blood with some substance like ebonite, particles of which do not become entangled with the clot; (2) to wash the magma under a current of water, but without kneading, for 24 hours; (3) to weigh the fibrin in the dry state after an exposure to a temperature of 105° for 48 hours; and (4) not to allow the fibrin, after its deposition, to remain in contact with the liquid from which it originated. This last condition is necessitated by the fact here designated fibrinolysis: that is, fibrin left in contact with the blood slowly disappears; the average of about 15 experiments shows a loss of about 8 per cent. of fibrin in 18 hours. W. D. H.

Densimetric Estimation of Albumin. By Theodor Lohnstein (*Pflüger's Archiv*, 1895, **60**, 136—138; compare this vol., ii, 191).—Further details are given, which have for their object the shortening of the operations previously described, so that an estimation may be made in half an hour. W. D. H.

General and Physical Chemistry.

Dissociation and the Optical Rotation of Active Compounds. By Eberhard Rimbach (*Zeit. physikal. Chem.*, 1895, **16**, 671—676).—If the increase of the optical rotation of an active compound consequent on dilution is due to dissociation, the degree of dissociation should be given by the formulæ $n = 100 \frac{[\alpha] - [\alpha]_0}{[\alpha]_\infty - [\alpha]_0}$, where $[\alpha]$ is the rotation of the solution examined, $[\alpha]_0$ and $[\alpha]_\infty$ that at infinite concentration and dilution respectively. The salt selected for examination was rubidium tartrate, and 10 determinations of the rotation were made, the concentration varying from 64·49 per cent. to 1·57 per cent. of the solution. From the results, by an extrapolation formula, the values $[\alpha]_\infty = 19·51$ and $[\alpha]_0 = 25·63$ were obtained. The degree of dissociation thus obtained, as compared with that found from the conductivity, gave the following results.

Per cent. of salt....	29·84	20·26	10·25	5·11	1·57
Electrolytic.......	39·4	46·9	56·0	62·4	72·9
Optical..........	53·5	69·2	83·8	92·4	97·7

The author considers that the divergence between the two methods is probably owing to a specific influence of the solvent at high concentrations; for example, in the formation of hydrates, decomposition of molecular complexes, &c. Experiments were also performed with light of other wave-lengths, namely, red, λ = 661; green, λ = 533; blue, λ = 489 and λ = 448; but the values for the dissociation are all closely concordant, so that the nature of the light appears immaterial. L. M. J.

Relation between Electrolytic Dissociation and Optical Rotation. By Giacomo Carrara and G. Gennari (*Gazzetta*, 1894, **24**, ii, 484—491; compare Carrara, Abstr., 1894, ii, 178, and Hädrich, Abstr., 1894, ii, 78).—A study of the optical activity of aqueous solutions of amyl hydrogen sulphate and its salts, and of diisoamylamine and its salts, shows that in fairly dilute solutions the molecular rotation of the salts is practically the same as that of the active base or salt contained in them; this is in agreement with the electrolytic dissociation hypothesis, the salts of strong acids and bases such as those used being highly dissociated in solutions of the concentrations employed.

Amyl hydrogen sulphate and its potassium, sodium, and ammonium salts, and diisoamylamine and its sulphate, acetate, and propionate were examined; cryoscopic determinations showed that the three metallic salts are highly dissociated in aqueous solutions of the concentrations used.

The slight differences between the observed molecular rotations is accounted for by the incomplete dissociation of the salts. No reference is made to the recent work of Walden (this vol., ii. 65) on the same subject. W. J. P.

Electrolytic Dissociation and the Law of Dilution in Organic Solvents. By GIACOMO CARRARA (*Gazzetta*, 1894, **24**, ii, 504—535).—In a previous paper (Abstr., 1894, ii, 310), the author has shown that the velocity of formation of triethylsulphine iodide from ethylic iodide and sulphide is considerably affected by the addition of various neutral solvents; with the object of ascertaining whether these alterations in the speed of the action are due to electrolytic dissociation set up by the solvent, determinations of the electrical conductivity of triethylsulphine iodide have been made in water, methylic, ethylic, propylic, isopropylic, primary and tertiary isobutylic, isoamylic, allylic, and benzylic alcohols and acetone. The electrical conductivity of very dilute acetone and methylic alcohol solutions is greater than that of the aqueous solutions, whilst in concentrated solutions the reverse is the case; not only then is water not the only solvent which induces electrolytic dissociation, but other solvents may act even more strongly than water in this respect. Piccini has recently investigated the very similar behaviour of chromic chloride dissolved in water and in methylic alcohol (this vol., ii, 229). In the cases of the saturated aliphatic alcohols, the dissociating powers of the various neutral solvents employed are of the same orders as the velocities of reaction between ethylic iodide and sulphide and as Menschutkin's values for the speeds of formation of tetrethylammonium iodide; considerable disproportionality is, however, noted when allylic or benzylic alcohol or acetone is employed as the neutral solvent; the purely qualitative nature of the agreement is probably due to the fact that the conductivities and speeds of reaction were measured at very different temperatures. On the ground of the determinations of the dissociation constants of triethylsulphine iodide in acetone and the various alcohols, the author concludes that the law of dilution holds in these organic solutions, and thus combats the conclusions of previous workers on this subject.

The extent to which electrolytic dissociation occurs in the organic solvents named above is found to be much smaller by the Beckmann method than by the electrical conductivity method; the discrepancy between the two methods is attributed to the existence of molecular complexes of the salt in solution as well as of chemical molecules and ions (compare Wildermann, Abstr., 1894, ii, 227).

The author examines qualitative similarities in order of magnitude between the dissociation constants, the dielectrical constants, and the coefficients of internal friction of the solvents employed in the present investigation and the molecular conductivities of dilute solutions of triethylsulphine iodide in them. W. J. P.

Thermochemical Carbon Battery. By DÉSIRÉ KORDA (*Compt. rend.*, 1895, **120**, 615—618).—Experiments made with a view to ascertain whether in the reduction of metallic oxides there is a development of electrical energy, show that only in two of the cases investigated is there any distinct electromotive force. Barium peroxide in contact with carbon heated at dull redness gives an E.M.F. of about 1 volt. Other peroxides, such as those of manganese and lead, show no similar behaviour, probably because the product of reduction is a conductor and forms short circuits with the carbon. Copper peroxide and carbon, when separated by fused potassium carbonate, give an E.M.F. of 0·9 to 1·1 volt. If the potassium carbonate contains water, the current is at first in the opposite direction, but changes as the temperature rises.

In both cases, the E.M.F. is considerably lower than that calculated from the known thermal disturbances, and it follows that only part of the energy is liberated as electrical energy. Faraday's law is not applicable, because of the continuous supply of extraneous energy in the form of heat. C. H. B.

Electrocapillary Phenomena. By H. Luggin (*Zeit. physikal. Chem.*, 1895, **16**, 677—707).—If mercury or an amalgam be made the cathode for the polarisation of an aqueous solution, the capillary constant increases with the E.M.F. until it reaches a maximum value, when the E.M.F. is equal to the potential difference between the metal and liquid; beyond this point, it decreases. Experiments were made in which the solution was replaced by a molten salt, namely, (i) a mixture of lithium and potassium bromides, (ii) sodium and lithium chlorides, (iii) zinc chloride, and (iv) potassium and sodium nitrates. For the two latter cases, curves are given with the capillary constant as ordinate and the potential difference as abscissa. In the case of the zinc chloride, no maximum is obtained, whilst it occurs in the case of the nitrates at 0·69 volt below the natural potential of the mercury. A number of observations are also recorded for aqueous solutions at equivalent concentrations. The first series of experiments was on alkalis and acids; for the former, the mean value for the maximum was −0·859 volt (0·915 to 0·835), for the latter the values varied from −0·922 to −0·849 volt, with a mean of −0·882. In the case of halogen salts and organic acids, the values vary within considerable limits, especially for the former. Here, therefore, the potential is not independent of the nature of the solution. The influence of the metal is next considered, experiments being made with mercury and with Lipowitz's alloy. The curves are not coincident, the alloy having its highest capillary constant at the natural potential and about 0·3 volt below that of the mercury. The author then discusses the bearing of these results on Helmholtz's theory, with which he considers they are not in accord, and which he regards as an unsatisfactory explanation. L. M. J.

New Fractionating Column. By Ernest Barillot (*Bull. Soc. Chim.*, 1894, [3], **11**, 929—931).—A modification of the Le Bel-Henninger column. The vapour, after leaving the flask by the usual exit tube, and before entering the condenser, passes through a series of bulbs, in which it is washed, at any desired temperature, by the liquid resulting from the condensation of its less volatile constituents. The temperature is regulated by means of a suitable bath, and the overflow from the bulbs carried back to the main column by special tubes

entering the latter at the junctions of the main bulbs. Trials with mixtures of methylic alcohol and acetone are stated to have yielded good results.
JN. W.

Comparative Investigation of the Methods of Fractional Distillation. By F. ANDERLINI and R. SALVADORI (*Gazzetta*, 1895, **25**, i, 1—31).—A large number of experiments with various forms of the fractionating columns of Wurtz, Linnemann, Glinsky, Hempel, Le Bel, Henninger, and Anderlini have been made with mixtures of alcohol and water, of benzene, toluene, and xylene, and of aniline and xylidine, in order to determine which pattern of column gives the most satisfactory results. A spiral form of fractionating column such as that devised by Anderlini (Abstr., 1894, ii, 329) seems to be one of the best, whilst the other types of column in use differ but slightly in efficiency under particular conditions.
W. J. P.

Dephlegmator for Fractional Distillation. By SYDNEY YOUNG and G. L. THOMAS (*Chem. News*, 1895, **71**, 177).—In the tube constituting the still-head, sharp constrictions are formed, at intervals of about 8 cm., and upon these rest discs of platinum gauze, through the centre of which pass hook-shaped short tubes open at both ends; the straight shaft of the hook extends slightly above the gauze, and is of larger bore than the hook, which is pendant below the gauze.
D. A. L.

The Critical Temperature as a Criterion of Chemical Purity. By RUDOLF KNIETSCH (*Zeit. physikal. Chem.*, 1895, **16**, 731—732).—The author had in 1890 pointed out that the critical temperature forms a good criterion of the chemical purity of a compound; he considers therefore that the priority for this belongs to himself, not to Pictet and Altschul (this vol., ii, 200).
L. M. J.

Thermal Constants of Calcium Oxybromide and Oxyiodide. By TASSILLY (*Bull. Soc. Chim.*, 1894, [3], **11**, 931—933).—*Calcium oxybromide*, $CaBr_2,3CaO,16H_2O$, prepared by adding lime (3 grams) in small portions to a warm solution of bromine (100 grams) in water (75 c.c.), crystallises in nacreous spangles composed of minute needles. The corresponding oxyiodide (Abstr., 1894, ii, 92) may be advantageously prepared in a similar manner. The oxy-salts are much less hygroscopic than the corresponding haloïds; they are soluble in dilute hydrochloric and nitric acids, but are decomposed by water and alcohol.

The heat of dissolution of the oxybromide in dilute hydrobromic acid is 63·55 Cal., and the heat of formation of the solid substance from its solid constituents is 76·45 Cal. The heat of dissolution of the oxyiodide in dilute hydriodic acid is 63·30 Cal., and the heat of formation of the solid substance from its solid constituents is 79·90 Cal. It is noteworthy that the heat of dissolution of the oxychloride in dilute hydrochloric acid is 63·12 Cal., so that the heats of dissolution of the three salts in the corresponding halogen acids are practically identical.
JN. W.

Heat of Formation of Mercuric Salts. By RAOUL VARET (*Compt. rend.*, 1895, **120**, 620—622).—The heat of formation of mercuric iodide was determined by dissolving the metal in a solution of iodine in potassium iodide. The heats of dilution of this solution, and the heats of dissolution of iodine and of mercuric iodide in potassium iodide solution, being also measured.

Hg liq. + I_2 sol. = HgI_2 cryst. red..... develops +24·7 Cal.

Direct determination of the heat of formation of mercuric bromide gave

Hg liq. + Br_2 liq. = $HgBr_2$ sol. .... develops +40·7 Cal.

which agrees with Nernst's value (40·5 Cal.).

From these results and Berthelot's earlier observations on the action of dilute hydracids on mercuric oxide, it follows that

Hg liq. + O gas = HgO sol........... develops +21·3 Cal.
Hg liq. + Cl_2 gas = $HgCl_2$ sol. .... ,, +49·8 ,,

C. H. B.

Isomeric Mercuric Oxides. By RAOUL VARET (*Compt. rend.*, 1895, **120**, 622—623).—Red mercuric oxide obtained by the action of heat on the nitrate was dissolved in dilute hydrocyanic acid at 12°.

HgO red + 2HCN dil. = $Hg(CN)_2$ diss.
+ H_2O liq......................... develops +31·55 Cal.

Berthelot found that under the same conditions and at the same temperature, yellow mercuric oxide develops +31·60 Cal. It follows that the conversion of the yellow into the red variety, or *vice versâ*, is accompanied by no thermal disturbance, a result which explains why both forms are equally stable at the ordinary temperature, unlike the yellow and red iodides. C. H. B.

Heats of Formation of some Iron Compounds. By HENRI L. LE CHATELIER (*Compt. rend.*, 1895, **120**, 623—625).—The substance under investigation was mixed with carbon and burnt in oxygen in the calorimetric bomb. Under these conditions, the heat of combustion of the substance is ascertained from the difference between the rise of temperature observed when the substance is present and when the same weight of carbon is burnt alone. The oxides of iron are converted into the oxide Fe_3O_4, the heat of formation of which is 4 × 67·2 Cal. Experiments were made with the two varieties of ferric oxide, one obtained by heating ferric nitrate at 400°, the other by heating the first product at 1000°. The results obtained are as follows.

$FeO + \frac{1}{3}O = \frac{1}{3}Fe_3O_4$.................. develops +25·2 Cal.
Fe + O = FeO...................... ,, +64·6 ,,
Fe_2O_3 ordinary = Fe_2O_3 calcined .... ,, + 2·14 ,,
Fe_2O_3 calcined = $\frac{2}{3}Fe_3O_4 + \frac{1}{3}O$ .... ,, −15·06 ,,
$2Fe + O_3 = Fe_2O_3$ calc. .... ,, +3 × 64·8 ,,
$2FeO + O = Fe_2O_3$ calc............... ,, +65·2 ,,

The combination of oxygen with ferrous oxide develops practically the same quantity of heat as its combination with iron.

$FeCO_3 + \frac{1}{3}O = \frac{1}{3}Fe_3O_4 + CO_2$ .... develops + 0·0 Cal.
$FeO + CO_2 = FeCO_3$ .... ,, +25·2 ,,
$FeCO_3 + SiO_2$ (quartz) $= FeO,SiO_2$.... ,, −15·2 ,,
$FeO + SiO_2$ (quartz) $= FeO,SiO_2$ .... ,, +10·0 ,,

With calcium carbonate and silica, the results are of the same order as with ferrous carbonate, as regards the difference between the heats of formation of carbonate and silicate.

$CaCO_3$ pptd. + SiO_2 quartz = CaO,SiO_2 develops −26·8 Cal.
$CaO + SiO_2$ (quartz) = CaO,SiO_2...... ,, +15·2 ,,

Comparison of the results obtained by the bomb method with those obtained in solutions indicate that the former is capable of considerable accuracy. C. H. B.

Chloraldehydes. By PAUL RIVALS (*Compt. rend.*, 1895, **120**, 625—627).—The heat of combustion of chloraldehyde is +233·5 Cal., the heat of formation from its elements is +63·4 Cal., and hence

$CH_3{\cdot}COH$ liq. + Cl_2 = $CH_2Cl{\cdot}COH$ liq.
+ HCl gas .... develops +28·3 Cal.

Taking Berthelot's value for the heat of formation of chloral from its elements (+77·0 Cal.), it follows that

$CH_3{\cdot}COH$ liq. + $3Cl_2$ = $CCl_3{\cdot}COH$ liq.
+ 3HCl........................... develops +28·6 × 3 Cal.

It would seem that the thermal disturbances accompanying successive substitutions of chlorine in aldehyde increase more regularly than in the case of acetic acid. The heat of formation of liquid dichloraldehyde from its elements is probably about +70 Cal.

The following table shows that the heats of formation of the chloraldehydes from their elements are practically identical with those of the corresponding chloracetic chorides.

$CH_3{\cdot}COCl$	+64·7 Cal.	$CH_2Cl{\cdot}COH$	+63·4 Cal.
$CH_2Cl{\cdot}COCl$	+69·8 Cal.	$CHCl_2{\cdot}COH$ (calc.)	+70·0 Cal.
$CHCl_2{\cdot}COCl$ (calc.)	+79·0 Cal.	$CHCl_3{\cdot}COH$	+77·0 Cal.

Regarding an acid chloride as derived from an aldehyde by the substitution of chlorine for hydrogen in the aldehydic group, it follows that the conversion of $CH_3{\cdot}COH$ into $CH_3{\cdot}COCl$ develops +29·6 Cal., $CH_2Cl{\cdot}COH$ into $CH_2Cl{\cdot}COCl$, +28·4 Cal., and $CCl_3{\cdot}COH$ into $CCl_3{\cdot}COCl$, +38·2 Cal. The last term obviously differs considerably from the others, and a similar difference has been observed by Berthelot and Louguinine in the heats of oxidation of the aldehydes to acids. $CH_3{\cdot}COH$ into CH_3COOH develops +62·6 Cal., and $CH_2Cl{\cdot}COH$ into $CH_2Cl{\cdot}COOH$, +62·5 Cal., but $CCl_3{\cdot}COH$ into $CCl_3{\cdot}COOH$ develops +67·7 Cal. C. H. B.

Crystallised Polymeride of Chloraldehyde. By PAUL RIVALS (*Compt. rend.*, 1895, **120**, 627—628).—The heat of combustion of the crystallised polymeride of chloraldehyde $(C_2H_3ClO)_n$ is $(+229·3\ Cal.)_n$, and its heat of formation from its elements $(+67·7\ Cal.)_n$, and hence the formation of the polymeride is accompanied by a development of +4·4 Cal. for each molecule of the chloraldehyde. It would seem therefore that this polymeride is analogous to metaldehyde and not to paraldehyde. The analogy is also seen in the fact that, like metaldehyde, it is only slightly soluble in water. C. H. B.

Relation between the Molecular Weight and Density of Liquid and Solid Substances. By UGO ALVISI (*Gazzetta*, 1895, **25**, i, 31—41).—The equivalent weight of a liquid or solid substance divided by its density gives a constant to which the term equivalent volume is given. The author has investigated the equivalent volumes of several series of salts, and finds that substances belonging to the same class have approximately the same equivalent volume; thus the chlorides, including chlorine and hydrogen chloride, have equivalent volumes of about 26, the bromides have a common equivalent volume of about 32, whilst for the iodides the value is about 38; very considerable variations from these numbers, however, occur, the highest values being obtained in the case of those salts, such as mercurous chloride and thallous chloride, the metals of which are capable of combining with a larger proportion of halogen; ferric and chromic chlorides have equivalent volumes much below the average. The equivalent volumes of the fluorides are about one-half of those of the corresponding chlorides. W. J. P.

Volumes of Aqueous Salt Solution between 100° and 150°. By K. ZEPERNICK and GUSTAV TAMMANN (*Zeit. physikal. Chem.*, 1895, **16**, 659—670; compare Abstracts, 1894, ii, 224, 268, 342, 410; this vol., ii, 204).—As the isobars for quantities of water which have the same volume at 0° again cut at about 120° or 130°, it appeared probable that if solutions at different concentrations possessing equal volumes at 0° were examined, they would be found to again have equal volumes at about this temperature; at least in those cases where Δk is independent of the temperature. The volume relations were therefore determined in the case of solutions of sodium, potassium, calcium, and hydrogen chlorides, sodium hydroxide, and sodium sulphate. Dilatometers furnished with an auxiliary bulb were employed, and the volumes taken directly at temperatures between 100° and 150°; corrections due to compressibility of the glass and solution have to be employed. The values so obtained for water are compared with, and are in all cases smaller than, those obtained by Hirn. Interpolation formulæ for the volume are obtained and the curves found to cut those of pure water at the following temperatures.

Sodium chloride	130°	164°	137°
Potassium chloride	126	127	121
Hydrogen chloride	116		

Hydrogen sulphate....	151°	151°		
Sodium hydroxide	127	129		
Sodium sulphate......	144	138		
Sodium carbonate.....	131	143		
Calcium chloride......	118	110	105°	96°

With the exception of those of calcium chloride, therefore, the isobars all cut that of water in the manner predicted. L. M. J.

Cause of Osmotic Pressure and Ionisation (Electrolytic Dissociation). By Isidor Traube (*Zeit. anorg. Chem.*, 1895, **8**, 323—337).—The author shows that the equivalent of any ion exercises always the same attraction for the water, and that this attraction is equal to that exercised by the molecule of any non-dissociated substance, the contraction caused by this attraction being for the gram-equivalent or molecule 12·2 c.c. (compare this vol., ii, 209). As equivalent quantities of different ions have all the same attraction for the solvent, their osmotic pressures must be the same. Therefore laws analogous to those of Boyle, Gay-Lussac, and Avogadro must hold for the osmotic pressure. When the electrolyte is dissolved in water, the same attraction that may be looked on as the cause of osmotic pressure also causes the weakening of the hold of the ions on one another. The law that equivalent amounts of the different ions produce, on being dissolved in water, the same contraction in volume, may be compared to Faraday's law that equivalent amounts of the different ions require for their separation the same quantity of electricity. Drude and Nernst regard the electrical charging of the ions as the cause of the volume contraction (*Zeit. physikal. Chem.*, **15**, 79). The analogy between the volume law and Faraday's law is, however, rather proof that the ions in solution are not electrically charged and only become so at the moment of their separation, the charging of the ions being the consequence and not the cause of the volume contraction, space energy being thus converted into electrical energy. H. C.

Molecular Weight Determinations of Solid, Liquid, and Dissolved Substances. By Isidor Traube (*Zeit. anorg. Chem.*, 1895, **8**, 338—347).—The method proposed is that described in a former paper (see this vol., ii, 209). In cases in which association of the molecules to complexes occurs, the factor of association $x = 12{\cdot}2/(V_m - v_m)$. Calculations of x for a large number of different compounds are given. In homologous series, x decreases with rising molecular weight, the decrease being most marked in the lower terms. Isomeric compounds often have different values of x. The hydroxyl group causes the greatest increase in x, but in this case also a decrease takes place with rising molecular weight. H. C.

Solubility in Mixtures of Alcohol and Water. By Guido Bodländer (*Zeit. physikal. Chem.*, 1895, **16**, 729—730).—The author had previously shown that the solubility, in mixtures of alcohol and water, of substances soluble in the latter but insoluble in the former may in some cases be expressed by the expression $W/\sqrt[3]{S} =$ constant, where W and S are the percentages of water and of the compound. The expression is now again tested for the compounds trinitrobenzene, benzamide, and alanine. In the case of benzamide, the expression is inapplicable, this compound being soluble in alcohol. For the other two the constancy of the expression is fairly satisfactory, especially in the case of alanine. The solubilities are taken from the experiments of Holleman and Antusch. L. M. J.

Isomorphism, XI. By JAN. W. RETGERS (*Zeit. physikal. Chem.*, 1895, **16**, 577—658; see also this vol., ii, 160).—The first portion of the paper deals further with the question of the chemical union of isomorphous salts and contains the results of the author's researches on mixed crystals of the salts of nickel and iron, iron and manganese, and copper and manganese, whilst a table of the literature dealing with the crystallography of the vitriols is also added.

The question of the isomorphism of cadmium with the metals of the zinc series is considered. Cadmium sulphate may be represented as $CdSO_4 + 3H_2O$, although the recorded analyses do not completely agree with this water content. The mixed crystals of this salt with the sulphates of iron and copper were examined, and owing to the existence of an extended series of mixed crystals with the former, the author considers that cadmium must be undoubtedly placed in the magnesium series.

A series of compounds of isomorphous elements are next considered, namely (1) compounds of the halogens such as ICl_3, &c., (2) double haloïd salts of metals and nonmetals such as $SnBr_2Cl_2$, &c., (3) compounds such as KI,I_2, which may, however, be regarded as pure additive products. With respect to the second class, the author considers that the evidence that they are really compounds and not mixtures is insufficient, whilst in the first class he points out that isomorphism of compounds does not necessitate isomorphism of the free elements.

I.	II.	III.	IV.	V.	VI.	VII.
H	Li	Be	B	C	N	O
Fl	Na	Mg	Al	Si	P	S
Cl	K	Ca	Sc	Ti	V	Cr, Mn, Fe, Co, Ni
—	Cu	Zn	Ga	Ge	As	Se
Br	Rb	Sr	Y	Zr	Nb	Mo, Ru, Rh, Pd
—	Ag	Cd	In	Sn	Sb	Te
I	Cs	Ba	La, Ce, Di, Sm, Er, Yb	—	Ta	W, Os, Ir, Pt
—	Au, Hg, Tl	Pb	—	—	Bi	Th, U

The supposed compounds of sulphur and selenium are regarded as mixtures only, the same holding for the double chromates and sulphates.

The next portion of the paper deals with the value of the etched-figures upon crystals in the problems of isomorphism. Many cases are indicated where the study of such figures, caused by various etching media, would be most useful in doubtful cases of isomorphism, and the author considers a very fruitful field of research to lie in this direction.

The table usually employed to illustrate the periodic law is next considered, and its chief defects pointed out, namely, (1) the position of hydrogen is uncertain, (2) the gaps are probably too numerous, and (3) the indication of isomorphism is unsatisfactory, whilst (4) many metals fall into their wrong position. A table (p. 309) is therefore given in which the author considers these objections are overcome. The first two columns may be united in one.

The paper concludes with a note on the law of the relation between chemical simplicity and crystalline form, which the author considers must, as pointed out by van't Hoff, be ascribed to Buys Ballot.

L. M. J.

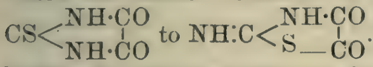
Affinity Constants of Dibasic Acids and of Acid Ethereal Salts. By RUDOLF WEGSCHEIDER (*Monatsh.*, 1895, **16**, 153—158).—The author shows that in a dilute solution of a dibasic acid, the numbers of the isomeric ions which are formed are proportional to the affinity constants of the two carboxylic groups, K_1 and K_2; and further that the constant of affinity of a dibasic acid is equal to the sum of the affinity constants of the two carboxylic groups, $K = K_1 + K_2$. If the acid is symmetrical, then the constants for the two carboxyls are identical, and the constant for the acid becomes double that for one of the carboxyls $K = 2K_1$. In unsymmetrical acids, the relationship of the constants for the two carboxyls is more complex. This relationship in the case of hemipinic acid may be obtained from the constants of the two isomeric monomethylic salts, K_α and K_β.

$$K_\alpha = a\,.\,K_1 \text{ and } K_\beta = a\,.\,K_2 \quad \therefore \ \frac{K_1}{K_2} = \frac{K_\alpha}{K_\beta} = \frac{1}{8}\,.$$

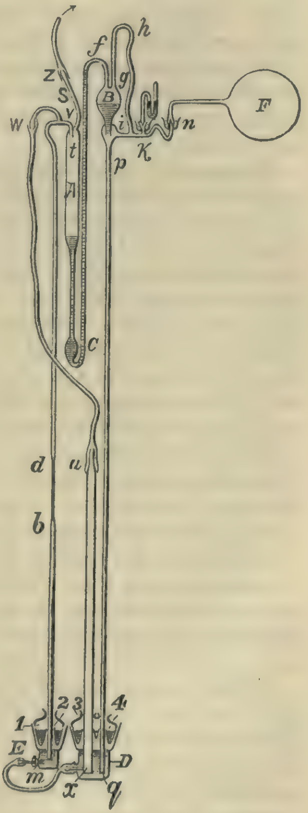
It is further shown that the following rules are approximately true. (1) The affinity constant of a symmetrical dibasic acid is double that of its mono-methylic or mono-ethylic salt. (2) The affinity constant of an unsymmetrical dibasic acid is equal to the sum of the constants for the two isomeric mono-alkylic salts.

J. J. S.

Affinity Constants of Ureïdes and Isonitroso-derivatives. By P. A. TRÜBSBACH (*Zeit. physikal. Chem.*, 1895, **16**, 708—728).—The paper contains the results of the determinations of the conductivity of a large number of carbamide derivatives. For carbamide itself, thiocarbamide, methylene carbamide, ethylene carbamide, and hydantoïn, the conductivities were all small; the highest value ($v = 256$) being 0·4. Parabanic acid, measured 20 minutes after solution, gave the value $\mu_{1024} = 10{\cdot}8$, but finally reached an end value of $\mu_{1024} = 242{\cdot}3$. This, and the end value of oxaluric acid, agreeing with the conductivity of carbamide oxalate at a similar dilution, indicates the hydrolysis of these two compounds and formation of the latter. Methylparabanic acid is, in a similar manner, shown to form methylcarbamide oxalate.

Thioparabanic acid gave $\mu_{1024} = 5{\cdot}7$, but, later, $\mu_{1024} = 3{\cdot}2$, a change which the author considers is due to the molecular change from  $CS<\begin{matrix}NH\cdot CO\\ |\\ NH\cdot CO\end{matrix}$ to $NH{:}C<\begin{matrix}NH\cdot CO\\ |\\ S-CO\end{matrix}$. A large number of derivatives of barbituric acid were next examined, the acid itself being found to form normal salts with only 1 molecule of a base. Alloxan, and a number of uracil derivatives are also examined, and a few isonitroso-compounds.

Of these, acetoxime is very feebly dissociated, being practically a non-electrolyte, the same obtaining to a less extent for phenylmethylketoxime. Quinonoxime shows indications of decomposition in the decrease of the affinity constant. In the case of the naphthol derivatives, α-nitroso-β-naphthol and β-nitroso-α-naphthol give identical results, both differing from, and smaller than, the values for α-nitroso-α-naphthol. L. M. J.



Automatic Vacuum-pump. By M. I. Pupin (*Amer. J. Sci.*, 1895, [3], **49**, 19—21).—A suction-pump and an ordinary Sprengel pump *Bq* are connected together by a syphon barometer *Cf*. The reservoir *A* is connected with a water or other suction-pump which draws the mercury from the vessels *E* and *D* up the tubes *mv*, *ux*, and when these vessels are emptied to the level of the lower end of the tube *mv*, the column of mercury in the latter tube (*mv*) is forced by the external air into *A*, whence it passes through the syphon *Cf* into the upper reservoir *B* of the Sprengel pump, and in descending again into *D* the vessel *F* is exhausted. L. J. S.

Inorganic Chemistry.

Action of Nitrous Oxide on Metals and Metallic Oxides. By PAUL SABATIER and J. B. SENDERENS (*Compt. rend.*, 1895, **120**, 618—620).—The authors have made, with nitrous oxide, observations similar to those already recorded in the case of nitric oxide and nitric peroxide (Abstr., 1892, 1151, 1271, 1390; and 1894, ii, 90). Cadmium, at about 320°, volatilises and oxidises at the same time, yielding a brown sublimate of the oxide. Finely-divided lead, obtained by reduction, oxidises slowly at about 300°, and yields yellow lead oxide. Reduced iron burns below 170° with formation of ferric oxide. Reduced cobalt burns incompletely at about 230°, and yields the brown monoxide. Reduced nickel oxidises with incandescence at 300°, and yields the monoxide. Reduced copper remains unaltered at 200°, but above 250° it is slowly transformed into red cuprous oxide; at a dull red heat there is some incandescence, but the product is the same.

Manganous oxide oxidises with incandescence at about 350°, and yields the pale brown oxide, Mn_3O_4. Tungsten dioxide, at about 450°, is converted, without incandescence, into the oxide W_2O_5 without any admixture of tungstic anhydride. Black molybdenum trioxide, Mo_2O_3, slowly changes into the violet oxide, MoO_2. Stannous oxide burns at about 400°, and yields stannic oxide. Cuprous oxide does not alter at 350°. Vanadium trioxide also is not affected below 500°. Uranous oxide, obtained by reducing uranic oxide in hydrogen at a bright red heat, is not affected by nitrous oxide at 450°, but if reduced at a lower temperature it burns in the nitrous oxide at about 400°, and yields the black oxide, U_2O_5.

Below 500°, the products of oxidation by nitrous oxide differ but little from those obtained from nitric oxide. Incandescence is only produced at a higher temperature, and is always less brilliant with nitrous than with nitric oxide.

Except in the case of iron, nitric oxide is a slightly more powerful oxidising agent than nitrous oxide. In both cases oxidation is due to the direct action of the gas, and cannot be attributed to its preliminary decomposition with liberation of oxygen; if this were the case, cuprous oxide would be oxidised.

When nitrous oxide is passed into sodium peroxide fused at about 300°, sodium nitrite is formed, and nitrogen is liberated, as Vernon Harcourt has previously observed. A similar result is obtained with barium peroxide below a red heat. Lead peroxide, on the other hand, splits up into lead monoxide and oxygen, whereas, with nitric oxide, it yields nitric peroxide and basic lead nitrate. C. H. B.

Action of Heat on Carbon Bisulphide. By HENRYK ARCTOWSKI (*Zeit. anorg. Chem.*, 1895, **8**, 314—317).—The author has examined the decomposition which takes place when carbon bisulphide is slowly distilled through a glass tube heated at 600°. The product, after 15 distillations, was subjected to fractional distillation. Two hundred and fifty c.c. came over at 46·2° under 752 mm. pressure; the residue, which was olive-green, was more viscid than carbon bisulphide, and yielded, on distillation, 20 c.c. at 46·5°, 16 c.c. at 47·1°, 8 c.c. at 48·5°, and a residue of 5 c.c., which consisted of an oily, red liquid, having a very evil odour; finally, there remained in the distillation flask a small quantity of brownish-red oil, which did not distil. This red oil the author believes to be the carbon sesquisulphide, described by v. Lengyel (Abstr., 1894, ii, 90). When heated on a watch-glass at 120°, it is converted into a black mass; when dissolved in chloroform and treated with bromine, a bright yellow precipitate is obtained: when allowed to remain exposed to air, it is converted into the black modification; this dissolves slowly in a solution of potassium hydroxide, and the red solution, when neutralised with hydrochloric acid, gives a precipitate of brown flocks.

The combustion tube through which the carbon bisulphide is distilled, becomes covered with a light black, lustrous mirror, which is not, however, due to the deposition of carbon, as it contains sulphur.

E. C. R.

New Element from Bauxite. By R. S. Bayer (*Bull. Soc. Chim.*, 1894, [3], **11**, 1155—1162).—In preparing alumina on the manufacturing scale, red bauxite from Var is fused or boiled with caustic or carbonated alkali, and the alumina precipitated by carbonic anhydride from the alkali aluminate thus obtained. The residues contain the new element, in addition to iron, molybdenum, vanadium, and many others. The amount is a mere trace, as the whole product from 1,000,000 kilos. of bauxite weighed only 2 grams. On this account, no stochiometrical determinations have yet been made, but the author hopes to furnish data later on.

It is unnecessary to enter into the details of the separation of the other elements, with the exception that the last to be eliminated were vanadium and molybdenum, with which the new element appears to be carried down by hydrogen sulphide from acid solutions, although it is not so precipitated when pure.

The element appears to exist in two states of oxidation, in the higher of which it forms a well-marked acid, which is probably allied to phosphoric and vanadic acids. The lower oxide is decidedly basic, although it appears to act under certain conditions as a feeble acid. Its compounds are, however, very unstable, and easily re-oxidised to those of the higher oxide.

The chlorides appear to be volatile, and afford well-defined spectra, having characteristic lines in the green, blue, and violet.

The *acid* is soluble in water, from which it is deposited, on evaporation, as a crystalline, yellow precipitate, fusing with difficulty at a bright red heat to a brownish-yellow mass. The *ammonium* salt crystallises from water in olive-green cubes, and is insoluble in concentrated ammonia. The *barium* salt is greenish-yellow, and insoluble in water, but soluble in acids; the *mercurous* salt forms straw-yellow, twinned crystals, and is insoluble in water, but soluble in nitric acid; the *silver* salt forms green crystals, and is soluble in nitric acid and ammonia; the *magnesium* salt is formed, in the presence of ammonium chloride and ammonia, as a crystalline precipitate similar to magnesium ammonium phosphate. The acid resembles vanadic and phosphoric acids in forming a yellowish-white precipitate with nitromolybdic acid, but does not appear to react with hydrogen peroxide.

With alkali sulphides, it forms an intensely red solution, probably containing a *thio-acid*, as a sparingly soluble rust-coloured *sulphide* is precipitated from the solution by acids.

The acid is reduced by hydrogen sulphide in acid solution to the salt of a *lower oxide*, from which, after the hydrogen sulphide has been expelled in an atmosphere free from oxygen, alkalis precipitate a voluminous, dark, purple-brown *hydroxide;* this rapidly becomes crystalline, and is completely soluble in caustic alkalis, and partially in ammonia, yielding dark violet solutions, in which barium, strontium, and calcium chlorides produce violet precipitates.

JN. W.

Atomic Weight of Strontium. By THEODORE W. RICHARDS (*Zeit. anorg. Chem.*, 1895, 8, 253—273).—The author gives a critical account of the previous determinations of the atomic weight of strontium. The methods employed in the present investigation are the determinations of the ratio of silver to strontium bromide and of the ratio of silver bromide to strontium bromide.

Strontium bromide is very similar to the corresponding barium salt. It crystallises with $6H_2O$, is very hygroscopic, and melts in its water of crystallisation at 100°; if allowed to remain in a desiccator for some time, it loses $5H_2O$. When heated in the air, it evolves a small quantity of bromine, but it can be dried in a current of dry hydrogen bromide, and the product thus obtained is neutral to phenolphthaleïn and methyl-orange. The sp. gr. of the product dried at 200° is 4·216 at 24°.

The determination of the atomic weight is carried out as follows. The finely-powdered material contained in a platinum boat is heated at 200° in a current of pure, dry air, then in a mixture of hydrogen bromide, nitrogen, and hydrogen at a red heat, and finally the excess of hydrogen bromide is driven over by a current of dry nitrogen and hydrogen. The hot boat is transferred as quickly as possible to a weighing glass, allowed to cool, and weighed. The ratio of silver to strontium bromide is determined as follows.

1st Series.—A small excess of silver is dissolved, diluted with about 100 times the amount of water, and the strontium bromide is shaken with it in a stoppered flask. The precipitate is separated by means of a Gooch's crucible, and the excess of silver estimated in the filtrate by Volhard's method. The mean of four experiments gave the atomic weight $Sr = 87·644$.

2nd Series.—The ratio is determined by titration with very dilute solutions of silver and hydrogen bromide according to the method described by Abrahall (Trans., 1892, 662). The mean of four experiments gave the value $Sr = 87·663$.

3rd Series.—Pure silver bromide when shaken with water dissolves to a slight extent, and the filtrate gives a faint opalescence both with silver solution and with hydrobromic acid. Slightly less silver solution than is required for the complete precipitation is added to the strontium bromide; and then a very dilute solution of silver (1 c.c. = 1 milligram Ag) is added drop by drop until two equivalent solutions of silver and hydrogen bromide produce an opalescence of equal intensity in the clear supernatant liquid. The mean of four experiments gave the value Sr = 87·668.

The ratio of silver bromide to strontium bromide is determined by precipitating the strontium bromide with a slight excess of silver nitrate. The precipitate is collected in a Gooch's crucible and treated by the usual method. The mean of seven experiments gave the value Sr = 87·6595.

The mean of all the experiments, discarding those obtained in the 1st Series, gave the value Sr = 87·663 when O = 16.

E. C. R.

Basic Nitrates. By Nicoles Athanasescu (*Bull. Soc. Chim.*, 1894, [3], **11**, 1112—1114).—Certain metallic nitrates, when heated in sealed tubes at suitable temperatures, are converted, like sulphates and selenates, into basic salts. Thus, when the solution formed by boiling concentrated aqueous copper nitrate with excess of copper carbonate is heated for several hours at above 300°, a basic copper nitrate separates in small, emerald-green crystals, insoluble in water, but soluble in acids. The analytical results agree fairly well with those required by Gerhardt's formula, $Cu(NO_3)_2,3CuO,3H_2O$, which, in order to account for the tenacity with which the third molecule of water is held, may also be written as $OH\cdot NO(O\cdot Cu\cdot OH)_2$.

Jn. W.

Precipitation of Metallic Lead. By J. B. Senderens (*Bull. Soc. Chim.*, 1894, [3], **11**, 1163—1165).—The small globules of metallic lead deposited on a rod of that metal immersed in a solution of its nitrate, are not formed when the acetate is substituted for the nitrate.

The phenomenon is probably electrolytic, and may be explained by supposing that in casting the rod, its central and peripheral portions assume different physical states, owing to the difference in the rates of cooling. The difference of potential thus set up between different parts of the rod will then cause the passage of local currents through the solution.

In confirmation of this view, it is to be observed that a strip of lead, one side of which is polished and the other roughly crystalline, decomposes lead nitrate much more quickly than a strip polished entirely, the characteristic yellow colour of the nitrosonitrate appearing almost at once, whilst metallic lead and subsequently basic lead nitrate (next page) are precipitated. Since acetic acid is not capable of reduction under these conditions, the action does not take place in a solution of lead acetate.

Jn. W.

Preparation of Lead Dioxide. By Wilhelm Minor (*Chem. Centr.*, 1894, ii, 412; from *Techniker*, **16**, 80).—Lead oxide is introduced in the requisite amount of melted sodium hydroxide, and the necessary quantity of sodium nitrate is then added. The products of the fusion are sodium nitrite and plumbate, which, on boiling with water, yields a precipitate of lead dioxide of great purity.

L. DE K.

Lead Orthonitrate. By J. B. SENDERENS (*Bull. Soc. Chim.*, 1894, [3], **11**, 1165—1166).—*Basic lead nitrate*, $N_2O_5,2PbO,1\frac{1}{2}H_2O$ (preceding page), crystallises from hot water in monoclinic needles, and is quite stable in air; it loses $\frac{1}{2}H_2O$ at 100° and the remainder at 190°. If the latter be regarded as water of constitution, the formula may be written $N_2O_5,H_2O,2PbO + \frac{1}{2}H_2O$ or $Pb_4H_4(NO_4)_4 + H_2O$, thus representing the salt as a hydrated form of a lead hydrogen orthonitrate, $PbHNO_4$, corresponding with the acid orthophosphates of bivalent metals.

JN. W.

Thallium Hydrogen Carbonate. By GIOVANNI GIORGIS (*Gazzetta*, 1894, **24**, ii, 474—479).—On passing a current of carbonic anhydride for 2—10 weeks through a fairly concentrated solution of thallous oxide contained in a closed vessel over sulphuric acid, *thallium hydrogen carbonate*, $TlHCO_3$, is slowly deposited in needles. The pure substance was only obtained on one occasion by this method, the other preparations containing rather too much thallium; the conclusions of Lamy and Des Cloizeaux and of Jörgensen respecting the existence of this salt are partially erroneous.

W. J. P.

Action of Dry Hydrogen Chloride on Serpentine. By REINHARD BRAUNS (*Zeit. anorg. Chem.*, 1895, **8**, 348—351).—An answer to E. A. Schneider (this vol., ii, 166). The hydrogen chloride employed by Clarke and Schneider was mixed with traces of water which influenced its action. The presence of water induced the action of the hydrogen chloride and brought about the decomposition of the magnesium silicate. Water is formed during the decomposition of the magnesium silicate, and this increases the action of the hydrogen chloride and produces a further decomposition. The manner in which the hydrogen is combined in minerals containing hydrogen cannot be determined by this reaction, nor can the number of the the Mg·OH-groups from the amount of magnesium chloride obtained.

E. C. R.

Action of Magnesium on Manganous Salts. By JOSEPH G. HIBBS and EDGAR F. SMITH (*J. Amer. Chem. Soc.*, 1894, **16**, 822—823). —The authors have tried the action of magnesium on aqueous solutions of manganous chloride, both in the presence of alcohol and of alcohol and ether, with the object of reducing the oxidation of manganese, if any should appear, to a minimum. It has not, as yet, been satisfactorily solved whether the deposit contained metallic manganese or a kind of hydrated oxide. The fact that the sum total of the constituents of the products of the action—chlorine, magnesium, and manganese—are less than the quantity of material taken for analysis favours the latter theory.

L. DE K.

Chemical Character of Pyrites and Marcasite. By AMOS P. BROWN (*Chem. News*, 1895, **71**, 120—121, 131—132, 144—145, 155, 171—172, 179—181).—The author has investigated the two varieties of iron bisulphide found in nature, the brass-yellow pyrites and greyish-yellow or pale green marcasite; the former resists the action of air, and, when decomposed in the earth, gives rise to limonite frequently in pseudomorphs, whereas the latter oxidises readily, yielding generally ferrous sulphate and only occasionally limonite; pyrites is obtained when ferrous sulphide is deprived of iron by ferric salts or carbonic acid, marcasite when ferrous sulphate undergoes reduction by organic matter; the former has been obtained artificially. Specially selected pure specimens of each mineral were used in these experiments. They were shaken at intervals of 15 minutes, in a finely pulverised condition, with neutral aqueous solutions of potassium permanganate of four strengths, namely N/100, and 1, 3, and 5 per cent., for periods of one, two, three, four, and five hours, and at ordinary temperatures and at 100°, each particular test being repeated 10 times. After the solutions had acted for the required time, the sulphuric acid was determined in the solutions. Marcasite in most cases oxidised rather more quickly than pyrites, but in none of the experiments did the amount of sulphur oxidised reach the proportion oxidised in pyrites by electricity, by which agent all the sulphur of marcasite is oxidised readily, whilst less than half the sulphur of pyrites is attacked. No definite results were obtained by treating the two minerals with hydrochloric or sulphuric acid, cold, hot, dilute, or concentrated, nor with dry hydrochloric acid at 210°; but with the latter at 310°, 325°, or at a red heat, pyrites was more vigorously attacked than marcasite. In a current of ammonium chloride in an atmosphere of nitrogen at 335°, marcasite yielded ferrous chloride, pyrites the ferric salt, with small loss of sulphur in both cases. Heating at 200° with copper sulphate solution in sealed tubes, marcasite yielded a solution wholly ferrous, but with pyrites only 19·9 per cent. was ferrous, the rest ferric. Hence pyrites appear to have the composition $4Fe^{IV}S_2,Fe^{II}S_2$, marcasite, on the other hand, to be $Fe^{II}S_2$, or a polymeride of it. D. A. L.

New Nitroso-compounds of Iron. By KARL A. HOFMANN and O. F. WIEDE (*Zeit. anorg. Chem.*, 1895, 8, 318—322).—*Potassium dinitrosoferrothiosulphonate*, $Fe(NO)_2S_2O_3K,H_2O$, is obtained by passing nitric oxide into a concentrated aqueous solution of ferrous sulphate and potassium thiosulphate at the ordinary temperature. The solution turns dark brown, and then reddish-brown, metallic-looking plates of the new compound being precipitated; after drying in a vacuum over sulphuric acid, it has the above composition. It is sparingly soluble in water, but a small trace is sufficient to colour the water an intense yellow. In concentrated sulphuric acid, it dissolves, with an intense, greenish-yellow colour. The solution shows an absorption of blue and violet light of $\lambda = 514$, and, when heated, turns rose-red and decomposes. Alkalis decompose it only when warm, ammonia decomposes it at once. It is decomposed by hydroxylamine in the presence of alkali with evolution of gas and separation of ferrous hydroxide.

The *sodium salt*, $Fe(NO)_2S_2O_3Na + 2H_2O$, closely resembles the potassium salt, but is more soluble in water and alcohol, and gives an intense, brown solution. The alcoholic solution shows a characteristic absorption band $\lambda = 585$, and a more intense absorption of $\lambda = 516$. It is stable at 0°, but at the ordinary temperature evolves small quantities of nitric oxide.

The *ammonium salt* with $1H_2O$ crystallises in lustrous, black leaflets, and is much more stable than either the potassium or sodium salts. It can be crystallised from warm water without decomposition, and separates in large, lustrous, black plates.

The authors have obtained similar salts containing cobalt or nickel, and are engaged in their examination.

E. C. R.

Atomic Weights of Nickel and Cobalt. By CLEMENS WINKLER (*Zeit. anorg. Chem.*, 1895, **8**, 291—295).—The author has determined the atomic weight of iron by the method he employed for the determination of the atomic weights of nickel and cobalt (this vol., ii, 167). The iodine and other reagents employed were prepared exactly according to the method previously described. With pure, clean iron wire containing 0·1 per cent. of carbon and 0·3 per cent. of silicon, sulphur, phosphorus, copper, &c., the mean of three experiments gave the atomic weight $Fe = 56·0499$. With the same iron, after heating it in a current of pure hydrogen for one hour, the mean of three experiments gave the atomic weight $Fe = 56·0162$ ($H = 1$). These values are so close to the values obtained by other chemists that the accuracy of the method employed and the purity of the reagents is placed beyond doubt. E. C. R.

Colloïdal Gold. By PAUL SCHOTTLÄNDER (*Chem. Centr.*, 1894, ii, 409; from *Verh. Vers. Deutsch. Ntf. Arzte*, ii, 73—78).—The author prepares a deep violet-red solution which contains gold in a colloïdal form as follows. To a solution of 15·75 grams of pure crystallised cerous oxalate in 300 c.c. of boiled water is gradually added, while shaking, 400 c.c. of N/10 soda, and then at once 300 c.c. of a neutral gold solution, prepared according to Thomsen's method and containing 2 grams of gold. The mixture is first heated on the water bath, and then freely boiled for 1—1½ hours. The solution, which otherwise is very permanent, is precipitated by bases, acids, and salts, with the formation of red or blackish-violet deposits; these separate but slowly leaving an apparently blue solution. The precipitates caused by neutral salts of the alkalis contain, besides gold, basic ceric acetate; when incompletely dried, they readily redissolve in water and alcohol, but, after drying at 100°, they become completely insoluble. If a slightly acid solution of sodium acetate is added and the precipitate be redissolved in water and again reprecipitated, it will each time become richer in gold and poorer in cerium; but after repeated precipitation the compound becomes at last insoluble in water, and then contains about 53·7 per cent. of gold and 39·32 per cent. of cerium oxide, the remainder being combined acetic acid and water. The two metals cannot be separated by dialysis, as the cerium compound also exists in the colloïdal form. L. DE K.

Double Chlorides of Alkali Metals with Gold; Separation of the Alkalis from each other. By R. FASBENDER (*Chem. Centr.*, ii, 609; from *Ned. Tijds. Pharm.*, 1894, **6**, 227—229; compare Abstr., 1894, ii, 421).—The double chlorides of gold with potassium and rubidium differ from each other in their solubility in alcohol. The potassium salt dissolves in about four parts of 98 per cent. alcohol, whilst the rubidium salt requires about 54 parts. This distinction can be applied to the preparation of rubidium salts free from potassium. The rubidium salt, when dried at 100°, has the composition $AuCl_3,RbCl$; after reduction by means of oxalic acid, the rubidium can be determined as carbonate. A. G. B.

Mineralogical Chemistry.

Monazite from North Carolina. By H. B. C. NITZE (*Chem. News*, 1895, **71**, 181).—Monazite is found in various parts of North and South Carolina, the best crystallised specimens at Milholland's Mill and Stoney Point, Alexander Co. It occurs in stream sands and gravels, 1 ft. to 2 ft. thick, associated with quartz, felspar, hornblende, epidote, mica, magnetite, garnet, zircon, rutile corundum, &c., the primary source being crystalline gneisses and schists, of which it is an accessory constituent. The percentage of thoria varies, the transparent, greenish- and yellowish-brown varieties being stated to be the richest; at Brindletown, Burke Co., North Carolina, the sand runs from 4 to 6·6 per cent., near Shelley, in Cleveland Co., 2·76 per cent. It is separated by washing. D. A. L.

Chemical Composition and Constitution of Vesuvians. By PAUL JANNASCH and P. WEINGARTEN (*Zeit. anorg. Chem.*, 1895, **8**, 356—363).—The paper contains the results of the complete analysis of nine specimens of vesuvian. One series of these vesuvians contained fluorine; in the other, the fluorine is completely replaced by hydroxyl. The iron is present partly in the form of oxide; small quantities of manganese, potassium, sodium, and lithium are present even in the purest specimens, and occasionally rarer elements, such as titanium, occur. The results obtained are in accordance with the composition $(SiO_4)_2Al(Fe,Ti)Ca_2(Mg_2,Fe_2,Mn_2)H(K,Na,Si)$, or $Si_4O_{14}Al_2Ca_4(OH)_2$. E. C. R.

Cañon Diablo Meteorite. By ORVILLE A. DERBY (*Amer. J. Sci.*, 1895, [3], **49**, 101—110).—A meteoric individual weighing 195 grams was treated with cold hydrochloric acid of strength 1 to 10; analysis of the 92·95 per cent. (neglecting vein matter and a jagged nucleal piece) dissolved is given under I; this agrees with kamacite, $Fe_{14}Ni$. The residue was separated into groups; the analysis of the tænite is given under II (there being also 1·65 per cent. of schreibersite); III is one of the analyses given of the cohenite. Three forms of iron nickel phosphide occur, two of which, namely, acicular rhabdite and granular schreibersite, are probably identical; an analysis of a third form, strongly resembling mispickel in appearance, is given under IV; another analysis of the same shows 1·18 per cent. of tin. The non-magnetic portion of the residue was also examined.

	Fe.	Ni.	Co.	P.	Cu.	C.
I.	91·26	8·25		0·44	0·04	—
II.	66·46	30·28	0·68	0·30	0·32	—
III.	92·88	1·33		0·48	—	5·33
IV.	54·34	31·48	0·67	12·82	0·20	—

The occurrence of diamond in this meteorite (Abstr., 1894, ii, 195) is not confirmed. L. J. S.

Plymouth Meteorite. By HENRY A. WARD (*Amer. J. Sci.*, 1895, [3], **49**, 53—55).—The extreme dimensions of this meteorite, found in 1893, in Indiana, are given as $12\frac{1}{2} \times 7\frac{3}{8} \times 2$ in. Analysis gave—

Fe.	Ni.	Co.	Cu.	P.	Graphite.	S.
88·67	8·55	0·66	0·24	1·25	0·11	0·07

Small nodules of troilite occur embedded in the iron. A larger mass from the same locality, which has been lost, is mentioned.

L. J. S.

Physiological Chemistry.

Absorption of Fat. By VAUGHAN HARLEY (*J. Physiol.*, 1895, **18**, 1—14).—From experiments made on dogs, the following conclusions are drawn. Under normal circumstances, a dog absorbs from 9 to 21 per cent. of the total fat given in 3 to 4 hours; from 21 to 46 per cent. in 7; and 86 per cent. in 18 hours. The passage of fat from the stomach to the intestines varies with the individual, and with the time allowed for digestion. In 3 to 4 hours, 25 to 44 per cent. of the fat given has left it; in 7 hours, 33 to 63 per cent.; whilst in 18 hours all has entered the intestines. Of the fat that has actually entered the intestines, and therefore is under favourable circumstances for absorption; 37 to 76 per cent. is absorbed in 3 to 4 hours; 65 to 86 per cent. in 7 hours; and 86 per cent. in 18 hours.

In dogs which have had their pancreas removed, the quantity of fat given is not only again recovered, but a surplus is found which is probably derived from the intestinal secretion. The passage of fat from the stomach is very much delayed by extirpation of the pancreas. Such dogs pass in 4 to 6 hours 3 to 10 per cent. of the fat given into the intestines, whilst in 7 hours only 9 to 22 per cent. has traversed the pylorus. W. D. H.

Absorption of Salt Solutions from the Pleural Cavities. By J. B. LEATHES and ERNEST H. STARLING (*J. Physiol.*, **18**, 1895, 106—116).—Heidenhain (*Pflüger's Archiv.*, **56**) showed that absorption from the intestine is not simple osmosis, but that if the epithelium is paralysed by sodium fluoride, the absorption of salt solutions follows the ordinary laws of osmosis. The present experiments, which were performed on dogs, were made on this model; sodium chloride was the salt chiefly used, but experiments with other salts gave corresponding results. Absorption was found to obey the laws of osmosis; there was no evidence of vital action of the pleural endothelium, as the cells behave in the same way after being scalded or poisoned with sodium fluoride as in the normal condition. A small absorption of fluid by the lymphatics, due to the mechanical movements of the lung, has also to be reckoned with. W. D. H.

Action of Copper on the Animal Organism. By MAX KLEMPTNER (*Chem. Centr.*, 1894, ii, 620; from *Pharm. Zeit. Russ.*, 1894, **33**, 485—487).—The author used a solution of sodium cupric tartrate containing 0·0217 gram of copper oxide per c.c., and incapable of precipitating serum-albumin. With hæmoglobin, this solution yields a compound which is insoluble in water; in the case of ox's blood, pig's blood, and pigeon's blood, 1 gram of hæmoglobin will be precipitated by 0·035 gram of copper; in the case of dog's blood, cat's blood, and the blood of dead animals, the same proportion does not prevail.

For the estimation of small quantities of hæmoglobin, 0·1 c.c. of blood may be dissolved in 30 c.c. of water, and titrated with very dilute copper solution, until the filtrate is quite clear. Excess of copper in the filtrate may be detected by the addition of filtered dilute blood solution, when so little as 0·015 milligram of copper oxide will give a precipitate.

"Kupferhämol" is copper hæmoglobin, and behaves like "zinkhämol," which, according to Kobert, is a zinc parahæmoglobin. Copper hæmoglobin contains 2 per cent. of copper; it is insoluble in dilute alcohol, and in neutral solutions of alkali salts, but dissolves in dilute organic and inorganic acids, which, however, gradually decompose it. Organic and inorganic bases colour copper hæmoglobin solution red, and the liquid shows the oxyhæmoglobin spectrum; when dissolved in potassium cyanide or ammonium hydrogen sulphide, it shows the hæmochromogen spectrum, and in sulphuric acid it shows the hæmatoporphyrin spectrum. Water which has been shaken with turpentine dissolves copper hæmoglobin forming a brilliant red solution.

The following symptoms are to be noticed in poisoning by sodium cupric tartrate. Atrophy, both in acute and chronic cases; diarrhœa, some time before death, and persistent vomiting, in chronic cases; enfeebled pulse and laboured respiration. When subcutaneously injected in the pleura, the salt produces weakness and stiffness of the hinder extremities; the same is noticed when the salt or copper hæmoglobin is exhibited. In one case, blood and albumin were found in the urine; copper was not found in the blood serum, but in the blood corpuscles. A. G. B.

Poisoning by Barium Salts. By ANGIOLO FUNARO (*L'Orosi*, 1894, **17**, 397—403).—Particulars are given of the symptoms and post-mortem appearances in a case of poisoning by 30—50 grams of barium chloride taken internally. Small quantities of the metal were separated from the stomach, both in a soluble and insoluble form; a small quantity of soluble barium salt was also isolated from the liver, showing that the poison had been absorbed by the system. The metal was also found in the heart, the muscles, and the kidneys.

W. J. P.

Chemistry of Vegetable Physiology and Agriculture.

Enzyme of Schizosaccharomyces Octosporus and of Saccharomyces Marxianus. By EMIL FISCHER and PAUL LINDNER (*Ber.*, 1895, **28**, 984—986).—So far as it has at present been ascertained, it appears probable that the fermentation of the polysaccharides by saccharomycetes is preceded by their conversion into monosaccharides through the agency of enzymes (compare this vol., i, 6 and 161). It was therefore to be expected that *Schizosaccharomyces Octosporus*, which, according to its discoverer, Beyerinck (*Centr. Bacter.*, **12**, No. 2, 49), ferments maltose, but not saccharose, secretes a glucase (maltase), but no invertase, and this hypothesis has been verified by experiment. A pure culture of the yeast was washed with water, dried on a porous plate, at the temperature of the room for three days, pulverised, and digested with 20 parts of water for 20 hours at 33°. The clear, filtered extract was found to have no action on saccharose; when, however, maltose (1 part) was treated with the extract (10 parts) for 20 hours, at 33°, both in presence of chloroform and otherwise, the phenylhydrazine test indicated the production of more glucosazone than maltosazone. α-Methylglucoside was also hydrolysed by the extract, but the reaction proceeded somewhat more slowly than in the case of maltose. The authors have not yet succeeded in isolating the enzyme.

Saccharomyces Marxianus, according to Hansen, ferments saccharose, but not maltose. The observation of Fischer and Thierfelder (*Ber.*, **27**, 2031), that this yeast ferments maltose, is now found to be incorrect. An aqueous extract of the air-dried yeast hydrolyses saccharose completely, but has no appreciable action on maltose.

A. R. L.

Behaviour of Yeast towards Glycogen. By ALFRED KOCH and HANS HOSAEUS (*Chem. Centr.*, 1894, ii, 869; from *Centr. Bacter. und Parasitenk*, 1894, **16**, 145—148).—To test Errera's hypothesis and the generally accepted opinion concerning the self-fermentation of yeast, the authors have tried whether yeast can make use of animal glycogen added to an artificial nutrient solution. For this purpose, Frohberg yeast, compressed yeast, and beer-yeast were grown in a solution containing 0·5 per cent. of glycogen. It was found that the presence of the glycogen did not increase the growth of the yeast; the small quantity employed did not diminish, even after a long time, under the influence of the yeast, but the diverse bacteria which accompanied impure cultures speedily decomposed it, so that the nutrient solution soon failed to show the glycogen iodine reaction. No glycogen was found to have been formed in the yeast cells at the expense of the added glycogen, and very little alcohol was produced. Even Frohberg yeast, which is able to ferment maltodextrins, behaves towards glycogen in the manner described. Each of the three kinds of glycogen used (that from the dog and the calf, and from yeast) diminished the yeast harvest and the quantity of alcohol produced, both in very poor (flesh extract) and in very good (beer-wort) nutrient solutions; qualitatively, there appeared to be no difference between the action of the three kinds, but quantitatively there was a slight difference.

These experiments show that in the solutions employed, yeast does not give rise to a diffusible ferment, which can so act on animal or yeast glycogen as to produce a fermentable, diffusible substance. On the other hand, the question remains open whether the yeast can make use of the glycogen which exists within itself. A. G. B.

Cell-membrane of Fungi. By EUGÈNE GILSON (*Chem. Centr.*, 1894, ii, 874—875; from *La Cellule*, 1894, **11**, 7—15).—*Claviceps purpurea* was treated according to the method for obtaining E. Schulze's cellulose (Abstr., 1891, 1178; 1892, 907). The finely-powdered material, freed from fat, was treated several times with a 0·5 per cent. soda solution, washed with water until the washings were no longer alkaline, and heated for six hours with a 2½ per cent. sulphuric acid solution. After the residue had been washed with water, it was left in contact with a mixture of 12 parts of nitric acid (sp. gr. 1·15) and 1 part of potassium chlorate for 14 days. The acid was then washed away, and the residue digested at 60° for one hour with very dilute ammonia, and finally washed and dried.

The product is coloured neither by iodine and strong sulphuric acid nor by zinc chloride containing iodine; it is insoluble in Schweizer's reagent, and is entirely different from cellulose. To ascertain whether the substance is a mixture or a compound of cellulose with another substance, it was treated, according to Hoppe-Seyler's method, with caustic potash, and then washed with water, whereby the cellulose was left. The product obtained in this way from *Claviceps purpurea* is coloured by iodine and sulphuric acid, but is totally different from cellulose. It is insoluble in Schweizer's reagent and in hydrochloric acid of medium strength, but it dissolves in cold, very dilute hydrochloric acid, and this solution is precipitated by a few drops of strong acid. It also dissolves in warm dilute sulphuric acid, but separates again when the solution is cooled. This substance, which is nitrogenous, and is also obtainable from *Agaricus campestris*, is called mycosin by the author.

Mycosin, $C_{14}H_{28}N_2O_{10}$, is best prepared by precipitating a solution of its crystalline hydrochloride by potash; it then forms an amorphous, granular, yellowish-white precipitate. It is only coloured by iodine and sulphuric acid and by iodine and zinc chloride when these reagents are sufficiently dilute. The *hydrochloride*, $C_{14}H_{28}N_2O_{10},2HCl$, is a white, slightly-reddish powder, which appears crystalline under the microscope, and is active towards polarised light; it is soluble in water, but not in alcohol; it is not coloured by reagents containing iodine. The *sulphate* is very similar, but is only soluble in hot water.

A. G. B.

The Place of Tannins in Plant Metabolism. By G. MIELKE (*Ann. Agron.*, 1895, **21**, 87—88; from *Progr. d. Realschule v. d. Holzthore in Hamburg*, 1893).—The phenols, with their acids and anhydrides (wrongly termed tannic acids, owing to their reaction with iron salts and potassium dichromate), which occur in nearly all plants, are derived from carbohydrates. Alcohols and aldehydes are formed as intermediate products, the importance of which is indicated by their presence in the cambium layer of plants. There is no evidence showing that the tannins can be produced from proteïds. In their formation from carbohydrates, the phenols, phenol-alcohols, and aldehydes migrate in combination with sugar, and play an important part in furnishing the materials necessary for covering the wood. The tannic substances are deposited in relatively small quantities in the body of the plant. By the formation of anhydrides, by oxidation, and by dry distillation, they could furnish, on the one hand, phlobaphenes (colouring matters of the bark), on the other, the substances which transform alburnum into duramen. The resins and ethereal oils would be the final products of the tannins. N. H. J. M.

Analyses of Norwegian Hay Grasses. By F. H. WERENSKIOLD and E. SOLBERG (*Bied. Centr.*, 1895, **24**, 165—167; from *Tidsskr. Norsk. Landbr.*, 1894, **1**, 190—198).—Analyses of the following grasses, grown in a sandy soil not far from Christiana, were made:—(1) *Phleum pratense*, (2) *Festuca elatior*, (3) *Avena elatior*, (4) *Dactylis glomerata*, (5) *Agrostis stolonifera*, (6) *Bromus arvensis*, (7) *Alopecurus pratensis*. The following percentage results are given.

Water.	Ash.	Crude proteïn.	Crude fibre.	Crude fat.	N.-free extract.	Digestibility of proteïn.
1. 15·00	4·01	4·75	26·91	1·84	47·49	74·35
2. 15·29	5·36	5·34	27·29	2·17	44·45	75·3
3. 16·91	4·45	5·19	25·33	1·99	46·13	85·6
4. 17·52	6·88	6·82	26·28	3·00	39·40	78·25
5. 16·54	5·09	7·07	27·07	1·94	42·29	68·5
6. 16·44	3·71	4·19	29·60	1·50	44·56	77·6
7. 12·42	6·50	7·63	28·37	2·81	42·77	75·8

The number of samples analysed were: No. 1, four; No. 2, three; No. 4, six; No. 5, two; the rest one each (compare König, *Zusammensetz. u. Verdaulichkeit d. Futtermittel*). N. H. J. M.

Analytical Chemistry.

Nitrocellulose Filters. By HENRY N. WARREN (*Chem. News*, 1895, **71**, 165).—To facilitate filtration and incineration during the examination of phosphates and similar precipitates, it is suggested that ashless filter-papers should be immersed separately for five minutes in a mixture of nitric acid, sp. gr. 1·5, with an equal volume of good oil of vitriol, to obtain a rapidly-burning paper insoluble in ether; whilst, to obtain a paper burning with less rapidity and soluble in ether, a mixture of ordinary nitric acid with twice its volume of vitriol should be used, and the last mixture, with the addition of a small quantity of hydrofluoric acid, should be employed for the treatment of ordinary filter-papers. The papers must be washed free from acid, carefully dried, and preserved in stoppered bottles.

D. A. L.

Some Indicators. By P. A. BOORSMA (*Chem. Centr.*, 1894, ii, 447; from *Ned. Tydschr. Pharm.*, 1894, **6**, 205—213).—Phosphoric acid may be considered as a mono-, di-, or tri-basic acid, according to the nature of the indicator, methyl-orange (or cochineal), phenolphthaleïn, or Poirrier's blue. The results differ slightly when alkaline earths are used instead of alkalis. The titration with lime and rosolic acid is very accurate if the solution is well boiled. Litmus is not to be recommended, as it is carried down with the precipitate. Borates soon dissociate even in fairly concentrated solutions. Boric acid does not affect methyl-orange, but it sensibly acts on litmus and phenolphthaleïn. Using Poirrier's blue, it may be titrated as a monobasic acid, but it is best done in presence of at least 25 per cent. of glycerol.

Regarded in the nature of feeble acids, the indicators may be classified as follows :—Methyl-violet, methyl-orange, dimethylamidobenzene, congo, lacmoid, carminic acid, phenacetolin, azolitmic acid, rosolic acid, phenolphthaleïn, turmeric, and Poirrier's blue.

L. DE K.

A New Process for Drying Hygroscopic Substances. By KARL ZULKOWSKI and ENRICO PODA (*Chem. Centr.*, 1894, ii, 532—533; from *Ber. Österr. Ges. Chem. Ind.*, **16**, 92—98).—The following process is recommended for the complete drying of such substances as molasses, invert sugar, and the like :—10 grams of the sample is mixed with 50 c.c. of methylic alcohol in a flask connected with an air-pump, and then heated. The alcohol soon boils off, carrying over all the water. The remaining spirit and traces of moisture are then removed by passing a current of dried air for about half an hour.

L. DE K.

Estimation of Water in Silicates. By PAUL JANNASCH and P. WEINGARTEN (*Zeit. anorg. Chem.*, 1895, **8**, 352—355).—The method consists in heating the finely-powdered silicate mixed with dry borax in a tube of hard glass, and passing over it a current of dry air. If the silicate contains fluorine, the gases are passed through a column of dry lead chromate before absorbing the water. The combustion tube is bent in the centre so as to form a reservoir about 7 cm. long in which the mixture of silicate and borax is heated, and so that the outlet for the gases is constricted. The tube charged with borax is heated in a muffle at 270—280° for half an hour, a current of dry air being passed through it at the same time. It is then allowed to cool slowly, and the silicate introduced and mixed with the borax. The mixture is then heated until all the water is expelled, the water being collected in a weighed calcium chloride tube. E. C. R.

Estimation of Halogens in Organic Compounds. By JAMES WALKER and JAMES HENDERSON (*Chem. News*, 1895, **71**, 103).—The substance is heated in the ordinary way, in a sealed tube, with fuming nitric acid and silver nitrate, but the latter is employed in quantities in excess of that required to form a silver salt with all the halogen of the compound, and, moreover, is weighed accurately; so that at the close of the reaction, instead of weighing the silver chloride, the contents of the tube are washed into a flask, boiled to expel lower oxides of nitrogen, and the excess of silver nitrate is titrated with ammonium thiocyanate, using iron alum as an indicator; by this means, the amount of halogen present is easily ascertained. The thiocyanate is standardised against a portion of the silver nitrate used in the precipitations. D. A. L.

Estimation of Chlorine in Wool Grease. By P. LOHMANN (*Chem. Centr.*, 1894, ii, 901; from *Pharm. Zeit.*, **39**, 707—708). —The author has tested Benedikt's recent process and found that but little of the chlorine is absorbed by the lime, the greater part being lost in the gaseous products or the tarry matter. The following process is recommended:—The melted fat is cautiously dropped upon fusing sodium nitrate and carbonate mixture, the dropping-tube being weighed before and after the operation. The melt is afterwards examined for chlorine as usual. Although no doubt a small quantity of chlorine escapes with the gases formed during the combustion, still the process gives decided amounts of chlorine where Benedikt's process gives but traces. L. DE K.

Estimation of Chlorine in Wool Grease. By RUDOLPH BENEDIKT (*Chem. Centr.*, 1894, ii, 902; from *Pharm. Zeit.*, **31**, 733).—A reply to Lohmann (preceding abstract), stating that in the author's recent process the fatty vapours are passed over two separate layers of ignited quicklime, and that the second layer was always found to be free from chlorine, showing the completeness of the absorption.
L. DE K.

New Volumetric Method. By J. KNOBLOCH (*Chem. Centr.*, 1894, ii, 533—534; from *Pharm. Zeit.*, **39**, 558—559).—The author's process is based on the following facts:—When a solution of ferric chloride is mixed with the equivalent quantity of potassium fluoride, the decomposition is complete, and the resulting ferric fluoride solution is colourless. In this state, the iron is not detectable by potassium thiocyanate, salicylic acid, acetates, antipyrin, &c. Still more interesting is the fact that ferric fluoride does not liberate iodine from iodides. The following standard solutions are required:—1. N/10 *solution of potassium fluoride;* 5·809 grams of the ignited salt is dissolved in water up to 1 litre. 2. N/60 *solution of ferric chloride;* 19·0 grams of officinal ferric chloride solution is diluted to 1 litre. 3. N/30 *solution of sodium thiosulphate* made by diluting the usual N/10 solution with 2 vols. of water. 4. *Zinc iodide solution;* a mixture of 10 grams of iodine, 5 grams of zinc powder, and 25 c.c. of water is warmed until colourless, and then diluted to 40 c.c. This solution keeps better than potassium iodide solution.

1. *Estimation of Fluorine in Soluble Fluorides.*—The liquid is acidified with hydrochloric acid, and mixed with a known excess of ferric chloride solution, then with excess of zinc iodide, and allowed to remain in a closed vessel at 35—40° for half an hour; the liberated iodine is then titrated with the sodium thiosulphate solution. The volume of thiosulphate solution used is deducted from that of the ferric chloride, and the difference is the measure for calculating the fluorine, 1 c.c. of thiosulphate representing 0·0019 gram of the latter.

2. *Estimation of Calcium and Strontium in their Soluble Salts.*—The liquid, which should contain free hydrochloric acid, is mixed with excess of potassium fluoride solution, and then with the same volume of ferric chloride solution. After adding a sufficiency of zinc iodide and heating, as before, for half an hour at 35—40°, the liberated iodine is titrated. One c.c. of thiosulphate = 0·002 of calcium. Lime in drinking-water may be estimated in this manner, before and after boiling. Nitrous acid should be estimated and allowed for, as it also liberates iodine. L. DE K.

Estimation of Sulphur in Urine. By HENRI MOREIGNE (*Bull. Soc. Chim.*, 1894, [3], **11**, 975—977).—The residue obtained by evaporating urine is fused in a porcelain crucible with a mixture of sodium nitrate and carbonate, and the sulphate in the product estimated in the usual way. The crucible does not break on cooling if sodium nitrate is used, although it is liable to do so when potassium nitrate is substituted for it. JN. W.

Estimation of Total Nitrogen in Urine. By HENRI MOREIGNE (*Bull. Soc. Chim.*, 1894, [3], **11**, 959—975).—Petit and Monfet's modification of Kjeldahl's method (Abstr., 1893, ii, 343) is inaccurate, as the results vary with the amount of mercury used. The inaccuracy is partly due to the formation of tetramercurammonium sulphate, a substance which is precipitated by the caustic alkali, and not completely redissolved by the acid. If the mercury is omitted, the method is quite accurate, although distinctly more tedious. JN. W.

Estimation of Total Nitrogen in Urine. By PIERRE H. BAYRAC (*Bull. Soc. Chim.*, 1894, [3], **11**, 1139—1142).—The modification of Kjeldahl's process, referred to by Moreigne (preceding abstract), appears to have been devised by Henninger in 1884, and subsequently modified by Kjeldahl and Borodin, and by the author.

The method as now recommended consists in heating a mixture of the urine (10 c.c.) with concentrated sulphuric acid (5 c.c.) at 80° until the water is expelled, and then gradually raising the temperature until white fumes are evolved. When, after five or six hours, the liquid has become almost colourless, it is diluted (to 50 c.c.), and some of the solution (2·5 c.c.) washed into a gas measuring tube; after making alkaline with concentrated caustic soda (2 c.c.) it is decomposed with hypobromite. JN. W.

The Gunning Method for Estimating Total Nitrogen in Fertilisers. By W. E. GARRIGUES (*J. Amer. Chem. Soc.*, 1894, **16**, 795—799).—The Gunning method originally worked out for substances free from nitrates has of late been also recommended for manures containing the latter. Instead of simply boiling with potassium sulphate and sulphuric acid, some salicylic acid and some sodium thiosulphate must be added to the mixture.

To obtain fairly correct results, 1 gram of salicylic acid should be dissolved in 30 c.c. of sulphuric acid and mixed with about 2 grams of the sample contained in a 250—500 c.c. flask. Five grams of sodium thiosulphate is then added in four or five portions; when dissolved, 10 grams of potassium sulphate is added, and the operation is then conducted as usual. L. DE K.

New Method for the Estimation of Nitrous Oxide. By GEORGE T. KEMP (*Chem. News*, 1895, **71**, 108—111).—The method of estimating nitrous oxide by exploding or burning with hydrogen not being satisfactory, other means have been tried. Burning with carbon and exploding with carbonic oxide proved defective. But burning with considerable excess of carbonic oxide (7 : 1) and absorbing the carbonic anhydride formed has given good results when water is not present in excess of that required to saturate the gases, as the water suffers decomposition and the liberated hydrogen seems to enter into some condensible combinations, and high numbers are then obtained. The mixed gases are burnt over mercury in a grisoumeter by means of a spiral of platinum wire heated by an electric current.

D. A. L.

Estimation of Phosphorus in Coal and Coke. By LYCHENHEIM (*Chem. Centr.*, 1894, ii, 535; from *Trans. Amer. Inst. Min. Eng.*).—The ash left on incinerating the sample in a platinum dish, with constant stirring, is dissolved in 40 c.c. of hydrochloric acid, the solution evaporated to 10 c.c., mixed with 40 c.c. of nitric acid (sp. gr. 1·42), again evaporated to 20—25 c.c., and then diluted with water. After filtering from the silicic acid, the liquid is neutralised with ammonia and mixed with 40 c.c. of molybdate solution. The yellow precipitate is afterwards titrated. L. DE K.

Estimation of Phosphorus in Iron. By P. BÉNAZET (*Bull. Soc. Chim.*, 1894, [3], **11**, 1083—1091).—An account of the processes used in the various iron works on the Loire. The phosphorus, in nitric acid solution free from chlorine, is precipitated by molybdate at 45°, no arseniomolybdate being formed at that temperature. Large quantities of arsenic are best eliminated, however, as chloride. The ammonium phosphomolybdate is either weighed as such or as molybdenum phosphomolybdate, after ignition at 400—500°, or else estimated colorimetrically by the stannous chloride method, or volumetrically by oxidation with permanganate after reduction with zinc and boiling dilute sulphuric acid. JN. W.

Volumetric Estimation of Officinal Phosphoric acid, by JULIUS LANGER; **and Remarks on the same,** by CARL GLÜCKSMANN (*Chem. Centr.*, 1894, ii, 600—601; from *Pharm. Post*, **27**, 369—370, 370—371).—Schneider and Geissler have stated that officinal phosphoric acid may be accurately titrated with standard soda (free from carbonate) using phenolphthaleïn as indicator, but the author did not obtain satisfactory results. Glücksmann's indirect process gave, however, exact results. This method consists in precipitating the acid with magnesia mixture containing a known amount of ammonia, and titrating the excess of the latter with N/10 oxalic acid, using litmus as indicator. Three mols. of ammonia represent one mol. of trihydrogen phosphate. The magnesia solution is best prepared by dissolving 20 grams of magnesium sulphate and 10 grams of ammonium chloride in water, and adding 75 grams of ammonia. The whole is then made up to 500 c.c.

Glücksmann, in reply, states that the indirect process recommended by Maly gives, under favourable conditions, trustworthy results, but the precautions to be taken are so many that the method is quite unsuited for pharmaceutical purposes. L. DE K.

Estimation of Phosphoric acid by the Molybdate-Magnesia Method. By B. W. KILGORE (*J. Amer. Chem. Soc.*, 1894, **16**, 793—795).—A known quantity of crystallised sodium phosphate (dissolved in water) was sent to 28 analysts for the estimation of the phosphoric acid by the molybdate-magnesia method. The bulk of the analyses gave results decidedly in excess of the theoretical quantity, 19·826 per cent., in one case coming up to 20·67 per cent. Some, however, came very near to theory, and in their cases the magnesium precipitate had been purified by redissolving in hydrochloric acid and reprecipitating with ammonia. All the other precipitates contained no doubt an excess of magnesia.

Addition of a little citric acid before adding magnesia mixture also prevents precipitation of magnesium hydroxide. L. DE K.

Estimation of Arsenic in Organic Matter. By ERNEST BARILLOT (*Bull. Soc. Chim.*, 1894, [3], **11**, 958—959).—A modification of Marsh's process. The organic matter having been destroyed by any of the well-known methods, the arsenic is precipitated as sulphide, and then oxidised by nitric acid and potassium nitrate. The nitric acid having been expelled by sulphuric acid at 200°, and the absence of nitrates and nitrites proved by means of brucine and metaphenylenediamine, the liquid is introduced by degrees into a Marsh's apparatus, the tube of which is heated in three distinct places. If the rate of evolution of hydrogen is properly adjusted, practically the whole of the arsenic is deposited in the first region, a mere trace being precipitated in the second, and none at all in the third, thus rendering it certain that none has passed out of the apparatus. The operation is at an end when no further deposit takes place in the second and third regions on allowing the first region to cool. The sections containing the deposits are then cut out, and the arsenic weighed by difference. JN. W.

Estimation of Carbon in Iron. By FRITZ FOERSTER (*Zeit. anorg. Chem.*, 1895, **8**, 274–290).—The paper contains a critical account of the methods usually employed. The method employed by the author consists in heating the sample of iron, either in the form of fine filings or in lump, with lead chromate in a current of dry air free from carbonic anhydride. A full description and drawing of the apparatus is given in the original paper; it consists essentially in a thick-walled porcelain retort having a capacity of about 50 c.c., and which can be heated at a temperature of 1500°. About 1—3 grams of iron and 30—50 grams of fused lead chromate are employed. The mixture is at first heated cautiously until all violent action is over, and then at the full heat of the furnace. The results obtained with irons containing 2 per cent. or less of carbon agree with those obtained by the usual methods, but with specimens of iron containing 4 per cent. or more of carbon, the results are higher. E. C. R.

Decomposition of Silicates by pure Lead Carbonate. By PAUL JANNASCH (*Zeit. anorg. Chem.*, 1895, **8**, 364—367).—The lead carbonate employed is prepared by precipitating a hot solution of lead acetate with ammonium carbonate, and after washing the precipitate with water, drying it in a porcelain basin on the water bath. The silicate is mixed with 10—12 times the quantity of lead carbonate in a platinum crucible, and heated, at first gradually until the greater part of the carbonic anhydride is evolved, then at a red heat. The hot crucible and contents are thrown into cold water, treated with nitric acid, and the solution evaporated to dryness. The product is dissolved in nitric acid and water, separated from the insoluble silica, and the greater portion of the lead precipitated by the addition of concentrated hydrochloric acid. The salts are then converted into chlorides by evaporation with hydrochloric acid, and the remainder of the lead precipitated by hydrogen sulphide. The filtrate freed from hydrogen sulphide is then subjected to the ordinary methods for the separation of the metals. E. C. R.

The Hydrobromic acid Test for Copper. By GEORGES DENIGÈS (*Bull. Soc. Chim.*, 1894, [3], **11**, 1024—1027).—Sabatier's proposed modification of the test by substituting phosphoric acid for the sulphuric acid is unsatisfactory, as the resulting solution is unstable. If the author's original directions be adhered to, and a saturated solution of potassium bromide mixed at a low temperature with half its volume of concentrated sulphuric acid, a reagent is formed which is quite stable and very sensitive, an addition of a trace of a copper compound in any form producing an intense, crimson coloration. Any bromine which may be liberated after the lapse of time may be reduced by sulphite, without diminishing the sensitiveness of the reagent. JN. W.

Acidimetric Estimation of Molybdic acid. By KARL SEUBERT and WILLIAM POLLARD (*Zeit. anorg. Chem.*, 1895, **8**, 296—301).—The method is as follows :—A weighed quantity of the substance to be analysed is dissolved in the smallest possible excess of semi-normal sodium hydroxide with the aid of heat, a very dilute solution of phenolphthaleïn is added and then semi-normal hydrochloric acid until the solution becomes colourless. The mixture is boiled for 10 minutes and titrated back to redness with the standard sodium hydroxide. With hydrated molybdic acid, H_2MoO_4,H_2O, the mean of four experiments was 100·01 per cent. of that required by theory. With potassium trimolybdate, $K_2Mo_3O_{10}$, the reaction takes place according to the equation $K_2Mo_3O_{10} + 4NaOH = K_2MoO_4 + 2Na_2MoO_4 + 2H_2O$, and the results obtained agree with that required by theory. With molybdyl chloride, MoO_2Cl_2, prepared by heating molybdenum dioxide in dry chlorine, the reaction takes place according to the equation $MoO_2Cl_2 + 4NaOH = Na_2MoO_4 + 2NaCl + 2H_2O$; the mean of two experiments gave 64·47 per cent. MoO_2, instead of 64·45 per cent. With ammonium molybdate, $(NH_4)_6Mo_7O_{24},4H_2O$, the reaction takes place according to the equations $3(NH_4)_2MoO_4 + 6NaOH = 3Na_2MoO_4 + 6NH_3 + 6H_2O$ and $4MoO_3 + 8NaOH = 4Na_2MoO_4 + 4H_2O$. Before titrating with acid, the mixture must be boiled until all the ammonia is expelled, and thus the ammonia may be estimated at the same time. The results agree with those required by theory. E. C. R.

Quantitative Separation of Metals in Alkaline Solution by Hydrogen Peroxide. By PAUL JANNASCH and A. RÖTTGEN (*Zeit. anorg. Chem.*, 1895, **8**, 302—313).—*Separation of Bismuth and Cadmium.*—About 0·5 gram of each metal is treated with concentrated nitric acid (5 c.c.) and water, and the solution evaporated to dryness on the water bath ; the dry product is then dissolved in nitric acid (5 c.c.) and water (25—30 c.c.) and poured into a solution of concentrated ammonia (15 c.c.) of 3 to 4 per cent. mixed with hydrogen peroxide (25—30 c.c.) (Abstr., 1894, ii, 482). The bismuth is completely precipitated as the hydrated peroxide, and carries down with it 0·5—0·6 per cent. of the cadmium ; to separate this, the precipitate, after being washed with dilute ammonia and water, is redissolved in dilute nitric acid, and again precipitated and washed. The dried precipitate is removed from the filter-paper, which is incinerated and treated with nitric acid; the precipitate is then added, and the whole carefully heated in a platinum crucible until a constant weight is obtained. The bismuth oxide thus obtained contains any traces of silica which may have been present in the hydrogen peroxide, and this is estimated in the usual way. The cadmium is estimated in the filtrate by converting it into chloride and then precipitating with potassium carbonate. The precipitate is washed with cold water, dried at 100°, separated from the filter-paper, and after igniting the latter, the whole is heated in a platinum crucible until a constant weight is obtained.

The Separation of Lead and Cadmium is effected in a similar manner to the above. The precipitate of hydrated lead dioxide which contains small quantities of cadmium is separated from the filter-paper and redissolved, the portions adhering to the filter-paper being dissolved in dilute nitric acid to which a small quantity of hydrogen peroxide is added. The lead is then again precipitated, and the precipitate treated in the same way as for bismuth.

The Separation of Manganese and Copper by this method requires more ammonia and hydrogen peroxide; 0·5 gram of copper sulphate and manganese sulphate dissolved in 30 c.c. of water and 10 c.c. of concentrated nitric acid are poured into 40 c.c. of ammonia and the same quantity of hydrogen peroxide solution, and the mixture warmed on the water bath. The hydrated manganese peroxide is washed with ammonia and hydrogen peroxide, redissolved, and again precipitated. The filtrate contains most of the silica, which is separated in the usual way; and finally the copper is precipitated by hydrogen sulphide and weighed as oxide.

Manganese and cadmium are separated in the same way as manganese and copper. E. C. R.

Separation of Bismuth, Lead, and Manganese from Mercury, by means of Hydrogen Peroxide. By Paul Jannasch and E. v. Cloedt (*Ber.*, 1895, **28**, 994—996).—The separation was carried out, as previously described (Abstr., 1894, ii, 482), by pouring a solution of the mixed nitrates into dilute ammoniacal hydrogen peroxide. The bismuth, lead, or manganese is precipitated as a peroxide, and is free from silica if the hydrogen peroxide has been purified shortly before use by distillation under reduced pressure. The mercury is obtained by evaporating the filtrate in order to drive off the ammonia, making strongly acid with sulphurous acid, diluting, warming somewhat, and precipitating with hydrogen sulphide. C. F. B.

Diazobenzenesulphonic acid as a Reagent in Water Analysis. By J. J. Couvée (*Chem. Centr.*, 1894, ii, 930; from *Ned. Tydschr. Pharm.*, 1894, **6**, 313—317).—This reagent has been recommended to detect urine and excreta in water as it causes a yellow coloration when sewage is present.

The author, however, states that water containing iron also gives the reaction, so that this metal should be first tested for.

L. de K.

Estimation of Thiophen in Benzene. By Georges Denigès (*Compt. rend.*, 1895, **120**, 628—630; see this vol., i, 411).

Anthracene Testing. By Henry Bassett (*Chem. News*, 1895, **71**, 202—203).—Finding that chromic acid varies in quality, and in the quantity of sulphuric acid it contains, the author has tried the effect of these variations when testing anthracene. Good quality anthracene is but slightly affected, but with inferior qualities the results are considerably affected by deficiency of chromic acid; this is, however, compensated for to a great extent by the presence of sulphuric acid. A considerable variation in the quantity of this latter acid has very little influence on the results. D. A. L.

Quantitative Testing of Ethereal Oils. By SCHIMMEL (*Chem. Centr.*, 1894, ii, 899; from *Pharm. Zeit.*, **31**, 735).—The estimation of the amount of ethereal salts (chiefly acetates) is often a good way of ascertaining the purity of ethereal oils. It must, however, first be ascertained whether the sample contains any aldehydes, for instance, cinnamaldehyde; should any be present it must be removed. Of the purified oil, 1—2 grams is boiled for 1—2 hours in a 100-c.c. flask attached to a reflux condenser with 10—20 c.c. N/2 alcoholic potash; the excess of alkali is then titrated and the ethereal salt calculated. This in conjunction with the sp. gr. will indicate whether a given oil is adulterated with turpentine, oil of lemon, &c.

To estimate the alcoholic constituents, 10—20 c.c. of the sample is boiled with an equal bulk of acetic anhydride, and 1—2 grams of anhydrous sodium acetate for 1—1½ hour in a reflux apparatus. After cooling, the contents is digested with water to dissolve the excess of acetic anhydride, and after introducing the mixture into a separating funnel, the oil is drawn off, dried over anhydrous sodium sulphate, and its amount of combined acetic acid estimated as directed. This is a valuable test, as some oils, although in most respects undistinguishable, differ very much in the amount of alcohols of high molecular weight that they contain. L. DE K.

Technical Analysis of Asphaltum. By LAURA A. LINTON (*J. Amer. Chem. Soc.*, 1894, **16**, 809).—The authoress, after due consideration of existing processes, recommends the following method of analysis:—A suitable portion of the sample is weighed in a four-ounce Erlenmeyer flask and treated over-night with 50 c.c. of light petroleum. The liquid is then decanted on a tared filter placed within a 3-in. funnel provided with a stop-cock in the neck. The residue is digested for a few hours with some more of the solvent, which is then again decanted; after repeating the operation until the liquid runs off colourless, the whole of the bitumen is transferred to the filter. The flask is dried in a steam bath and weighed, any increase being subtracted from the amount determined as petrolene. The filter is thoroughly washed with light petroleum, dried with its counterpoise in the steam bath, and weighed, the loss representing the petrolene.

The flask is thoroughly rinsed with boiling oil of turpentine and the liquid added to the filter in the closed funnel, the filter being wholly submerged under the liquid. The digesting and filtering is repeated until the filtrate becomes colourless. The turpentine is now in turn displaced by repeated washing with chloroform and the filter dried and reweighed; the loss in weight represents the asphaltene. The filter is now burnt and the mineral residue, after treating with ammonium carbonate, is then weighed, the loss on ignition representing other organic matter, or coke in the case of artificial asphalt. L. DE K.

Estimation of Mannitol in Wines. By JOSEPH A. MULLER (*Bull. Soc. Chim.*, 1894, [3], **11**, 1073—1080).—In quantities greater than 0·1 per cent., mannitol may be detected by evaporating the wine, when it is left in characteristic patches of radiating needles.

The optical method, of which an outline has already been given (this vol., ii, 141), is described in detail in the present paper. The wine (200 c.c.), after expulsion of the alcohol and removal of the sugars by fermentation with pressed yeast (2 grams), is evaporated to dryness, and the residue boiled for an hour with 90 per cent. alcohol (220—230 c.c.). The solution of mannitol thus obtained is separated from the insoluble gums and other substances, and allowed to crystallise.

If the percentage is large, the mannitol may be weighed as such, and the 10 per cent. or so remaining in the mother liquor calculated from the solubility.

If the percentage is not large, or if a more accurate result is required, the mannitol, after washing with absolute alcohol, is dissolved in water, and the solution, decolorised with animal charcoal, is examined polarimetrically, first alone, and then in the presence of borax, the percentage being calculated in the manner already described (*loc. cit.*). It is important that the liquid should be absolutely clear, and as nearly as possible colourless. The mother liquor is purified by means of basic lead acetate and animal charcoal, and examined polarimetrically in the same way. To correct for the lessened effect of the borax on the rotatory power in the presence of glycerol (*loc. cit.*) it is determined for a third time, after the addition of a known amount of mannitol. If the percentage of glycerol is small, as is usually the case, the diminution of the increment due to the borax is proportional to the amount of mannitol present, so that if p_1 and p_2 be the amounts deduced respectively from the second and third observations, and p that subsequently added, the amount originally present in the mother liquor was $x = pp_1/(p_2-p_1)$. This relation is only true, however, when the amount $p + x$ in the solution is less than 2 per cent. The process of correction may be simplified by means of a table given in the original paper. The specimen results quoted are quite satisfactory.

The solubility of mannitol in alcohol of various strengths and at various temperatures is given in the following table.

Percentage strength of alcohol..	80·0	85·0	90·0
Percentage of mannitol at 3°...	0·556	0·338	0·160
„ „ 17...	0·615	0·351	0·166
„ boiling point.....	11·44	6·25	3·62

JN. W.

Detection of Glucose. By A. JAWOROWSKI (*Chem. Centr.*, 1894, ii, 537; from *Pharm. Zeit. Russ.*, **33**, 487).—Three c.c. of urine is mixed in a test-tube with 0·3 gram of potassium iodate and 0·6 gram of fused sodium hydroxide, the whole boiled for one minute, quickly cooled, and four drops of ammonia added; the tube is then inclined and 20 to 30 drops of dilute hydrochloric acid is slowly added. After this the tube is placed upright and the contents are gently stirred; where the acid and alkaline solutions meet, a ring is formed. In presence of little glucose, the ring is brownish, darker than the layer of urine below; from the latter it is separated by a colourless, a pale raspberry coloured, or a dirty raspberry coloured layer. The characteristic brown ring disappears after one minute when the amount of sugar is very small, but reappears on gently stirring. If, instead of ammonia, starch paste is used, the mixture becomes blue on adding the acid. Although normal urine behaves in the same way, the author believes that the reaction may serve as the basis of a colorimetric process for estimating sugar in urine.

L. DE K.

Estimation of Glycuronic acid by its Yield of Furfuraldehyde. By F. MANN and BERNHARD TOLLENS (*Chem. Centr.*, 1894, ii, 83; from *Zeit. Ver. Rubenzuck-Ind.*, 1894, 426—437).—It has been shown that when glycuronic acid is heated with hydrochloric acid, furfuraldehyde, carbonic anhydride, and water are produced. The carbonic anhydride obtained by distilling glycuronic acid with hydrochloric acid amounted to 26·5 per cent. of the glycuronic acid, whilst that obtained from dextrose or levulose by similar treatment amounted to 1 per cent. The furfuraldehyde which glycuronic anhydride yielded by the same treatment was 15·23 per cent. of the anhydride. Those natural compounds, which readily give glycuronic acid when heated with dilute acids, also yield furfuraldehyde when distilled with hydrochloric acid, and the proportion obtained will be a measure of the glycuronic acid which may be separated from such compounds. Thus euxanthic acid yields 6·16—7·17 per cent. of furfuraldehyde, urochloralic acid 9·88—10·30 per cent., and potassium urobutylchloralate 9·50 per cent. A. G. B.

Estimation of Tannins. By AIMÉ GERARD (*Compt. rend.*, 1895, **120**, 358—360).—The method proposed by the author (Abstr., 1882, 1327) of estimating tannins by means of purified sheep-gut employed in the form of violin strings, sometimes fails to give accurate results, but this is due to imperfect purification of the gut which, as purchased, often contains variable quantities of water, fat, and salts soluble in water.

The gut, prepared as carefully as possible, should be obtained in the untwisted form from the makers of violin strings, and purified in the laboratory. It is treated three or four times in the cold with crystallisable benzene in order to extract the fat, and after exposure to air, so that the benzene may evaporate, is washed with water and allowed to dry with free exposure to air at the ordinary temperature, care being taken that the sheets are kept separate during the drying.

C. H. B.

Sunflower Oil. By D. HOLDE (*Chem. Centr.*, 1894, ii, 79—80; from *Mitt. Techn. Vers-A. Berlin*, 1894, **12**, 36).—This oil is used for dietetic purposes, and finds application as an adulterant of the more valuable oils which are similarly employed. The addition of sunflower oil to lubricating oils is injurious on account of the drying properties of the oil. From the undecorticated seed, the author extracted, by means of ether, 26—28 per cent. of a clear yellow oil of agreeable taste; sp. gr. 0·9240 at 15°; iodine absorption, 135; "saponification number," 193; acidity, 5·6 per cent. (as oleic acid) coefficient of expansion, between 20° and 78°, 746—748 (*sic*). The oil is clear at −5°, turbid at −10°, and partly solid at −17°; its viscosity is, on Engler's scale, 8·2 at 20°, 5·5 at 30°, 3·9 at 40°, and 3·1 at 50°. The Bechi test gives no reaction with the oil; the Milliau test gives a yellow colour with a brownish shimmer. In a thin layer, the oil dries solid in five days. A. G. B.

Reactions of Chelidonine with Phenols. By J. A. Battandier (*Compt. rend.*, 1895, **120**, 270—271).—In these experiments, the reagent was mixed with concentrated sulphuric acid, and the alkaloïd introduced at the edge of the mixture. Guaiacol gives an intense and persistent crimson colour; thymol, a rose colour slowly becoming purplish; phenol, a rose tint; oil of cloves, a purple colour more intense than the brown produced by the action of the acid on the reagent; α-naphthol, a dull green; β-naphthol, a brownish colour changing to violet; catechol, a rose colour changing to violet; quinol, yellowish; resorcinol, yellowish, giving place to the blue resulting from the interaction of the two reagents; phloroglucinol, yellowish; pyrogallol, red changing to yellow; gallotannic acid, yellowish, gradually changing to intense green. The ethereal derivatives of the phenols act, as a rule, like the phenols.

The green colour given by a sulphuric acid solution of chelidonine with a trace of nitric acid is produced by other oxidising agents, and is especially brilliant, with a trace of potassium chlorate or an arsenate. C. H. B.

Decomposition and Detection of Cocaïne in the Animal Body in Cases of Poisoning. By H. W. Glasenap (*Chem. Centr.*, 1894, ii, 220).—Cocaïne can be detected either as such or as ecgonine after 33 days' exposure to the influence of putrefying flesh or human blood. In cases of poisoning, however, if death has ensued within two hours, it will be found unaltered, but, if more than four hours have elapsed before death, it will be found (in the urine) as ecgonine. D. A. L.

Detection of Bile Pigment in Urine. By Adolf Jolles (*Zeit. physiol. Chem.*, 1895, **20**, 460—461; compare Abstr., 1894, ii, 171).—The following method is recommended for separating bile pigment from urine:—50 c.c. of urine, 5 c.c. of a 10 per cent. solution of barium chloride, and 5 c.c. of chloroform are shaken together; the chloroform sinks, and is removed together with a precipitate; the two latter are heated together on the water bath until the chloroform is evaporated and Gmelin's test is then applied to the residue.

W. D. H.

General and Physical Chemistry.

Spectra of Argon and the Aurora Borealis. By MARCELLIN BERTHELOT (*Compt. rend.*, 1895, **120**, 662—663).—During the action of the silent discharge on mixtures of argon and benzene vapour (this vol., i, 412) under the particular conditions of the discharge known as "rain of fire," there is developed an intense, greenish-yellow fluorescence, the spectrum of which shows lines and bands in the yellow, green, blue, and violet very similar to those observed in the spectrum of the aurora borealis. Some of the bands are crossed by black absorption lines, owing to the thickness of the fluorescent layer. The author suggests that the aurora borealis may be due to the production of a fluorescent modification or compound of argon under the influence of atmospheric electricity. C. H. B.

Argon and its Fluorescence Spectrum. By MARCELLIN BERTHELOT (*Compt. rend.*, 1895, **120**, 797—800).—Pure argon, when mixed with benzene vapour, and subjected to the action of the silent discharge, undergoes very little change of volume, and the condensation previously observed (this vol., i, 412) was probably due to the presence of nitrogen as an impurity.

With a coil connected with a Leyden jar, and giving a spark 10—12 mm. in length, the mixture of argon and benzene vapour becomes luminous after a time ranging from 15 minutes to four or five hours. It has a violet tint with a reddish "rain of fire." After some time the fluorescence becomes much more brilliant, and the colour changes to a brilliant green, and finally to blue. When this point is reached, the fluorescence will continue for several hours, but after a long time, especially if the intensity of the spark is increased, the fluorescence disappears, and only a very feeble luminosity remains. If at an earlier stage the discharge is interrupted, the fluorescence at once disappears, but on again completing the circuit it reappears, either immediately, or after a time increasing with the time that has elapsed since the interruption of the discharge.

The spectrum of the fluorescence consists of a number of bands in the violet and green, and especially in the orange-red. The most distinct are a yellow band, quite distinct from D, of wave-length about 579, crossed by black lines when the discharge has a certain intensity; a green band at about λ 547, also crossed by black lines; a brilliant violet band, at about λ 438, and another less brilliant, at about λ 436. None of these bands coincides with the helium line, nor with the principal line in the spectrum of the aurora borealis. They do, however, correspond with the bright lines of the spectrum of argon at low pressure. The band at 579 corresponds with Crooke's line at 575, and the band at 578 in the aurora spectrum; the green band corresponds with Crooke's group of lines between 555 and 549, and Crooke's line 5557 seems to correspond with the principal line of the aurora spectrum; the violet bands correspond respectively with

Crooke's lines at 433 and 430, and with an important band in the aurora spectrum. C. H. B.

Spectra of Selenium and Natural Selenides. By ARNAUD DE GRAMONT (*Compt. rend.*, 1895, **120**, 778—780).—Selenium in selenides is detected even more easily by the spectroscope than sulphur in sulphides (Abstr., 1894, ii, 434).—The following lines were found to be characteristic of the spark spectra of selenides. The Greek letters are used in the same way as by Salet, and indicate the lines which are most intense in the spectra of selenides as well as in that of pure selenium.

	6055·1	very distinct.
	5863·4	feeble.
	5747·0	feeble.
	5710·5	distinct.
	5623·2	distinct.
	5592·8	very distinct.
	5569·0	fairly distinct.
	5524·3	feeble.
	5391·0	very distinct.
	5373·5	very distinct.
α	5303·8	strong.
β	5270·3	strong.
	5252·1	strong.
	5233·2	feeble.
γ	5226·2	strong.
	5219·0	very fairly distinct.
δ	5175·8	strong.
	5153·0	very fairly distinct.
ε	5142·3	strong.
	5106·0	fairly distinct.
ζ	5098·0	fairly strong.
	5094·2	very distinct.
	5068·5	fairly strong.
	5026·0	fairly distinct.
η	4992·0	very distinct.
	4974·2	very distinct.
θ	4845·2	fairly strong.
	4840·4	fairly strong.
μ	4764·6	fairly distinct.
π	4604·0	very distinct.
	4563·0	fairly distinct.
	4216·0	diffuse.

Several lines seen in the spectrum of pure selenium are more or less masked in the spectra of selenides. The following were observed, and include lines not mentioned by Plücker and Hittorff.

6497·5
6478·0
6432·0
6296·0
6139·0
5697·0
5440·0
5115·5
5043·5
4742·0
4401·0
4321·0
4175·0
4134·0
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C. H. B.

Variations in the Rotatory Power of Tartrates. By P. FREUNDLER (*Ann. Chim. Phys.*, 1894, [7], **3**, 433—524, and 1895, [7], **4**, 235—271).—In this extended work, the author has prepared and studied the properties of 55 derivatives of tartaric acid, in the first instance with the object of testing Guye's law of the product of asymmetry (Abstr., 1893, ii, 204 and 561). If a, b, c, d are the masses attached to one of the asymmetric carbon atoms, and a and b are so selected that their difference is a constant one,

$$(a - b) = m = \text{const.},$$

then the formula for the product of asymmetry simplifies to

$$P = m(c - d)\frac{(a - c)(a - d)(a - c - m)(a - d - m)}{(2a + c + d - m)^6}.$$

This formula is first of all discussed analytically, with the object of determining the number and positions of the changes of sign, and the maxima and minima of rotatory power in each of the series under examination. Applying the results obtained in this way to the experimental determinations, it is found that the formula furnishes a sufficient approximation in the case of di- and tetra-substituted ethereal salts, when the masses are not equal, and the character of the substituted radicles is not altogether a different one. The author's work affords, therefore, generally a confirmation of Guye's law of asymmetry.

The author also discusses the question of the influence of organic solvents on the specific rotatory power of some of the ethereal tartrates (compare Abstr., 1893, ii, 562; and 1894, i, 68).

H. C.

The Measurement of High Temperatures and the Melting Points of some Inorganic Salts. By JOHN McCRAE (*Ann. Phys. Chem.*, 1895, [2], **55**, 95—99).—The author describes a small thermo-electric element which he uses for the determination of temperatures varying from 300° to 1400°. It consists of a junction of platinum and platinorhodium, and the author states that between the above limits the E.M.F. is approximately proportional to the temperature. By its means the following melting points were determined.

Sodium iodide......	694·7°	Strontium chloride..	853·7°
Potassium iodide....	722·7	Sodium carbonate...	856·7
Potassium bromide..	745·5	Sodium sulphate....	881·2
Sodium bromide....	761·1	Potassium carbonate	887·5
Calcium chloride ...	802·1	Barium chloride	915·6
Potassium chloride..	803·9	Potassium sulphate .	1058·9
Sodium chloride....	811·0		

The boiling point of stannous chloride was found to be 603·25°, whilst the temperatures of an alcohol flame, and the blue point and the hottest part of a Bunsen burner flame were determined as 1488°, 1542°, and 1725° respectively.

L. M. J.

Thermal Expansions of Aqueous Solutions. By CARL FORCH (*Ann. Phys. Chem.*, 1895, [2], **55**, 100—120).—The thermal expansions of a number of aqueous solutions were determined by the dilatometric method. A noticeable point in the experiments is the construction and employment of a stirrer of iron and platinum inside the bulb of the dilatometer itself, and actuated by rotating magnets. Solutions of the following salts were used. Hydrogen, lithium, sodium, potassium, and ammonium nitrates; hydrogen, lithium, potassium, hydrogen-potassium, zinc, and cupric sulphates; trihydrogen, dihydrogen-potassium, dipotassium hydrogen, and tripotassium phosphates, potassium bromide, potassium iodide, zinc chloride, potassium hydroxide, and sodium hydroxide. The concentrations were in all cases ½, 1, and 2 gram equivalents per litre. The results of the experimental determinations are recorded, and tables of the volumes and the coefficients of expansion for every five degrees are added.

L. M. J.

Relationship between the Latent Heats of Vaporisation and Fusion of Substances belonging to the same Family. By MARCELLIN BERTHELOT (*Ann. Chim. Phys.*, 1895, [7], **4**, 133—136).—If

L is the latent heat of vaporisation of a substance at the absolute temperature T, and under the pressure p, and u' and u, the volumes of the gas and liquid respectively,

$$\frac{\mathrm{L}}{\mathrm{T}} = (u' - u)\frac{dp}{d\mathrm{T}}.$$

If L is the molecular latent heat of vaporisation, u' will be the same for all substances, and where the molecular volumes of liquid compounds are the same, $(u' - u)$ will be constant.

If further, as appears to be the case in a large number of instances, $dp/d\mathrm{T}$ is approximately constant,

$$\mathrm{L} = \text{const.} \times \mathrm{T},$$

which is the well-known law of Trouton. The author supposes that a similar law would probably hold for the latent heat of fusion. It follows from this that in considering any chemical reaction, the variation of entropy by the simultaneous passage from the liquid to the gaseous state of the two systems compared, will be zero.

H. C.

Melting Point of the Elements as a Clue to their Genesis. By Charles T. Blanshard (*Chem. News*, 1895, **71**, 285—286).—The author points out that with elements of low atomicity and low atomic weight, the melting point varies directly as the atomic weight, whereas in the higher periodic series of elements the melting points are alternately high and low. As this same character is observed in homologous series of carbon compounds, it is inferred that the latter elements may be of higher grade than the former elements.

D. A. L.

Percussive Ebullition. By H. Wolpert (*Zeit. anal. Chem.*, 1895, **34**, 164—165).—The author has not found Beckmann's flask satisfactory (see Abstr., 1894, ii, 268, 444). He places in the neck of the flask a funnel, through which passes a blunt-ended glass rod resting on the bottom of the flask. This arrangement prevents superheating.

M. J. S.

Relations between the Multiple Proportions of Chemical Compounds and their Heats of Formation. By Marcellin Berthelot (*Ann. Chim. Phys.*, 1895, [7], **4**, 145—213).—The author compares the heats of formation of chemical compounds, related to one another in atomic composition according to the law of multiple proportions, in order to ascertain whether there is any direct relationship between the number of atoms of any particular element present and the heat evolved in the formation of the compound. Hydrogen compounds, halogen compounds, and more especially oxygen compounds, are compared in this way. It appears, in the case of the oxygen compounds, that although heat is, as a rule, developed on the introduction of each additional oxygen atom, the amount of heat evolved decreases as the number of oxygen atoms present increases. The following tables may be quoted in illustration.

Ethylene, C_2H_4 (*gaseous*).

+ O. Aldehyde, C_2H_4O, liquid + 71·7 Cal.
+ 2O. Acetic acid, $C_2H_4O_2$, liquid + 131·8 = 65·9 × 2 Cal.
+ 3O. Glycollic acid, $C_2H_4O_3$, solid + 174·9 = 58·3 × 3 Cal.
+ 4O. Glyoxylic acid, $C_2H_4O_4$, solid + 215·7 = 53·9 × 4 Cal.
+ 5O. Oxalic acid, $C_2H_2O_4$ + H_2O, solid + 277·6 = 55·5 × 5 Cal.

Propylene, C_3H_6 (*gaseous*).

+ O. Propaldehyde, liquid + 75·7 Cal.
+ 2O. Propionic acid, liquid + 131·9 = 66·0 × 2 Cal.
+ 3O. Lactic acid, liquid + 176·8 = 58·9 × 3 Cal.
+ 4O.
+ 5O. Malonic acid + H_2O, solid + 282·7 = 56·5 × 5 Cal.
+ 6O. Tartronic acid + H_2O, solid + 344·2 = 57·4 × 6 Cal.
+ 7O.
+ 8O. Mesoxalic acid + H_2O, solid + 440·1 = 55·0 × 8 Cal.

H. C.

Thermochemical Researches on Substitution in Mineral Chemistry. By MARCELLIN BERTHELOT (*Ann. Chim. Phys.*, 1895, [7], **4**, 433—487).—The author has collected and tabulated a large number of the most recent and exact thermochemical data relative to the heat changes accompanying the replacement of one halogen by another or by cyanogen, oxygen, sulphur, selenium or tellurium, in their metallic compounds, and also for the replacement of one metal by another. The data are given both for the salts in solution and in the anhydrous form. It appears generally that the heat change accompanying the replacement of one electro-negative element by another is independent of the nature of the electro-positive element, when the salts are in solution, but that this does not hold for the same compounds in the anhydrous condition. A similar regularity may be observed in the replacement of one metal by another.

H. C.

Heat of Formation of Calcium Carbide. By ROBERT DE FORCRAND (*Compt. rend.*, 1895, **120**, 682—684).—The heat of dissolution of calcium carbide in dilute hydrochloric acid with evolution of acetylene and formation of calcium chloride solution is +58·25 Cal. Adopting Berthelot and Matignon's numbers for the heat of formation of acetylene, it follows that

C_2 diamond + Ca solid = C_2Ca solid.... develops −7·25 Cal.
C_2 amorphous + Ca solid = C_2Ca solid.. ,, −0·65 ,,

If Berthelot's view that acetylene is formed from hydrogen, and gaseous carbon with development of +26·1 Cal., be accepted, the formation of calcium carbide from solid calcium and gaseous carbon develops +76·95 Cal.

C. H. B.

Compounds of Calcium and Barium Oxides with Alcohol. By ROBERT DE FORCRAND (*Compt. rend.*, 1895, **120**, 737—740).—The compound 3CaO,4EtOH, previously described (this vol., i, 259), dissolves in dilute hydrochloric acid, with liberation of +92·90 Cal., and hence the heat of dissolution in water, which takes place slowly, is +8·90 Cal., and

$3CaO$ sol. + $4EtOH$ liq. = $3CaO, 4EtOH$ sol. .... develops +55·56 Cal.

The value for CaO, +18·52 Cal., is higher than the heat of formation of the hydroxide, +15·10 Cal.

The values for the analogous compound, $3BaO,4MeOH$ (Abstr., 1886, 781) are, heat of dissolution in hydrochloric acid, +112·04 Cal. heat of dissolution in water, +28·94 Cal.; and heat of formation, +63·06 Cal., or +21·02 Cal. for BaO, whereas the heat of formation of the hydroxide is only +17·60 Cal. Moreover, in presence of a small quantity of water the hydrate $BaO,2MeOH + 2H_2O$ is formed (Abstr., 1886, 861), with development of +29·74 Cal. from liquid water and +26·88 Cal. from solid water.

The substance hitherto regarded as barium ethoxide is really a compound analogous to the preceding, and has the composition $3BaO,4EtOH$ (compare Abstr., 1884, 4). Its heat of dissolution in water is +49·07 Cal., and its heat of formation +45·09 Cal., or +15·03 Cal. for BaO, a value 2·57 Cal. lower than the heat of formation of the hydroxide.

These results explain why water decomposes the solution of barium oxide in ethylic alcohol, but not the solution in methylic alcohol.

The general result is that the oxides of the calcium group do not form true alkyl oxides, but only additive products, with alcohols of the methyl series.

C. H. B.

Thermochemistry of Barium and Strontium Iodides. By TASSILY (*Compt. rend.*, 1895, **120**, 733—735).—Crystallised barium and strontium iodides lose hydrogen iodide when heated in nitrogen, but can be obtained anhydrous by heating them in a current of dry hydrogen iodide. The heat of dissolution of barium iodide in water at about 16° is +10·3 Cal., and of strontium iodide at about 12°, +20·5 Cal., and hence

Ba solid + I_2 gas = BaI_2 solid .... develops + 13·7 + x Cal.
Ba solid + I_2 solid = BaI_2 solid .. ,, + 2·9 + x ,,

x being the heat of oxidation of barium, and

Sr solid + I_2 gas = SrI_2 solid .... develops + 123·1 Cal.
Sr solid + I_2 solid = SrI_2 solid.... ,, + 112·3 ,,

C. H. B.

Specific Gravity of Saturated Vapours. By GUSTAV BAUER (*Ann. Phys. Chem.*, 1895, [2], **55**, 184—212).—The specific volume of a vapour may be calculated from Clapeyron's equation, $r/u = AT(dp/dt)$, where p is the pressure in kilos. per sq. cm.; u the difference between the specific volumes (s and σ) of vapour and liquid, r the heat of vaporisation, t the temperature, T the absolute temperature, and A the equivalent of heat. The results thus obtained have not, however, shown good agreement with those experimentally obtained. The author has therefore redetermined the specific gravity of the saturated vapours of water, carbon tetrachloride, ether, alcohol, sulphurous anhydride, and chloroform. The method consisted in the accurate weighing of a closed copper vessel (silvered in some experiments) in (1) air and (2) the vapour under examination, necessary corrections for pressure, temperature and expansion of the copper being applied. The experiments with the water vapour were performed at three different localities, namely, Munich, Sonnblick, and Wendelstein; those with the other liquids were all performed at Munich. The density of the saturated aqueous vapour is found to be very closely represented by the linear function $\gamma = 0{\cdot}8101\ p.$, the mean difference between these and the observed values being about 0·5 per cent. The values obtained are compared with the observed values of Fairbairn, Wüllner, and Herwig, and with the numbers calculated by Zeuner, Frank, and Fliegner, the best agreement being obtained with the values of the two first observers. Above 600 mm., it is seen that the values depart considerably from those calculated by the use of Regnault's heat of vaporisation. The density referred to air at the same temperature and pressure, is seen to increase with the pressure, being 0·630 at 500 mm. and 0·650 at 760 mm. The determinations with the other liquids gave the following results.

	p.	γ.
Carbon tetrachloride	712·0 mm.	0·0052
Chloroform	725·5 „	0·004248
Ether	713·0 „	0·002865
Alcohol.....................	717·0 „	0·00149

These values according well with the numbers calculated by Zeuner.

L. M. J.

Temperature of Maximum Density of Water. By L. C. de Coppet (*Ann. Chim. Phys.*, 1894, [7], 3, 246—268).—If a number of thermometers are so placed in a vessel of water that their bulbs are all in the same horizontal plane, the thermometers themselves being in the same vertical plane, it will be found that on gradually heating or cooling the water, the temperature indicated by each thermometer shows a regular rise or fall for all ranges of temperature except those between 3·5° and 5°. Between 3·5° and 5° the change is an irregular one, so that if for each thermometer a curve is drawn by taking the temperatures as ordinates and times as abscissæ, each curve will be found to cut the others at some point between 3·5° and 5°, this point approximating to the temperature of the maximum density of water.

By taking the mean of a large number of determinations made in this way with both rising and falling temperatures, the author finds the temperature of the maximum density of water to be 4·005°, or 3·982° on the hydrogen thermometer.

H. C.

Temperature of Maximum Density and Freezing Points of Cane Sugar Solutions. By L. C. de Coppet (*Ann. Chim. Phys.*, 1894, [7], 3, 268—274).—The method adopted by the author for determining the temperature of maximum density of water (preceding abstract) has been applied to the determination of the temperatures of maximum density of cane sugar solutions.

The results may be expressed by the following empirical formula

$$t_m = 4\cdot01438 - 0\cdot4834\,P + 0\cdot00082455\,P^2,$$

where P is the weight of sugar in grams dissolved in 100 grams of water. This formula holds between the limits $P = 0\cdot344$ and $P = 11\cdot565$. The molecular reduction of the temperature of maximum density (compare Abstr., 1893, ii, 60) is calculated, a fairly constant value being obtained.

A comparison of the reduction of the temperature of maximum density D with the reduction of the freezing point C, shows that the ratio D/C has a nearly constant value, and approximates to 8. The values of D/C seem to depend, however, on the concentration, and show a slight regular increase as the concentration rises. H. C.

Saturated Solutions. By ALEXANDRE L. ÉTARD (*Ann. Chim. Phys.*, 1894, [7], **3**, 275—288).—By the method described in a former paper (Abstr., 1894, ii, 442) the author has determined the solubilities of mixtures of two salts in water at different temperatures. The results are expressed in percentages of the mixed salts, and of each salt taken separately, contained in the saturated solutions, and are also recorded in curve form.

The case of mixtures of sodium and potassium chlorides, which has been given in a previous communication (Abstr., 1890, 103), is first discussed. Mixtures of potassium chloride with potassium bromide and with potassium iodide, and also of potassium bromide with the iodide, were examined. The sum of the salts dissolved is usually represented by a straight line when plotted against the temperature, and the limit of solubility calculated from this, or the point at which, by reason of the increase in the proportion of salt and the decrease in the proportion of water, the latter has disappeared, appears in each case to coincide with the melting point of the lower melting constituent of the mixture. For $KCl + KBr$ this point is at 703°, and the mixture would then contain 25 per cent. KCl and 75 per cent. KBr. For $KCl + KI$ the point is at 638°, the mixture containing 20 per cent. KCl and 80 per cent. KI. For $KBr + KI$ the point is at 638°, the mixture containing 33·3 per cent. KBr and 66·6 per cent. KI.

An attempt was made to measure the solubility of the triple mixture $KCl + KBr + KI$ in water, as a function of the temperature, but it was found that the three salts could not exist simultaneously in a saturated solution, the chloride remaining undissolved in the presence of the other two salts.

The solubility of mixtures of potassium nitrate and sodium chloride was examined more particularly, on account of the interest of the results in connection with the technical preparation of potassium from sodium nitrate.

The following determinations serve to show the general character of the changes in solubility with rising temperature.

Temp.	Per cent. KNO_3.	Per cent. NaCl.	Σ.
18°	18·9	22·5	41·5
26	20·7	22·3	43·0
35	27·9	20·2	48·1
50	38·5	16·5	55·0
70	49·7	14·0	63·7
90	61·4	10·4	71·8
105	70·0	9·0	79·0
122	73·8	8·0	81·8
145	77·7	7·6	85·3
170	80·7	5·8	86·5

It is evident from these results that in the presence of potassium nitrate, sodium chloride becomes less and less soluble with rising temperature. This fact puts a somewhat different interpretation on the technical process above alluded to than that which is usually given. The limit of solubility appears to lie at 338°, the fusing point of potassium nitrate. Theoretically the solubility of the sodium chloride in the saturated solution would have here fallen to zero, but practically this limit could not be reached, as sodium chloride is soluble in fused potassium nitrate, and this new influence would come into force. Potassium nitrate and potassium chloride when mixed behave towards water at different temperatures just like the mixtures of potassium nitrate and sodium chloride.

Other mixtures examined were those of silver nitrate with potassium nitrate, the limit of solubility being at 198°, the melting point of silver nitrate and the mixture here containing 55 per cent. $AgNO_3$ and 45 per cent. KNO_3; of barium nitrate with barium chloride, limit of solubility at 474°, the melting point of barium nitrate, the mixture containing 67·7 per cent. $Ba(NO_3)_2$ and 32·3 per cent. $BaCl_2$; and of barium bromide with barium iodide. H. C.

Burner for Monochromatic (Sodium) Light. By RICHARD PŘIBRAM (*Zeit. anal. Chem.*, 1895, **34**, 166—167).—The lamp, of which a figure is given, affords a brilliant light for long periods. Its essential parts are a wire gauze atmospheric burner, platinum boats containing a mixture of equal parts of sodium chloride and bromide, and a casing with side tubulures and chimney. M. J. S.

Improvements in Glass Stopcocks. By H. WOLPERT (*Zeit. anal. Chem.*, 1895, **34**, 161—164).—The author has simplified and improved Winkler's 3-way stopcock by substituting a simple opening into the body of the hollow plug for the bent canal, shortening the plug, lengthening the shell, and narrowing it below the plug to a tube suitable for connection with caoutchouc tubing, thus avoiding the torsion of the caoutchouc tube, which with Winkler's pattern occurred when the plug was turned. M. J. S.

Simple Percolator. By RICHARD PŘIBRAM (*Zeit. anal. Chem.*, 1895, **34**, 167—169).—This is a funnel-shaped vessel with a perforated glass shelf near the bottom. Through the shelf passes a narrow tube, recurved at the top. A glass cover, carrying the condenser, is ground into the top of the funnel. The substance is placed on the perforated shelf, and the percolation is continuous, not intermittent.

M. J. S.

Safety Valve for Filter Pumps. By BERLEMONT (*Bull. Soc. Chim.*, 1895, [3], **13**, 33—34).—In place of an indiarubber valve, which is objectionable in working with volatile organic liquids, a cylindrical vessel, constricted at the middle, is interposed between the pump and the vessel in which a vacuum is to be maintained, the lower end being connected with the pump, and the upper with the vessel. In the lower chamber there is a glass float, which is ground at the top to fit the constriction, so that if any water regurgitates, the float is carried up, stopping its ingress into the exhausted vessel.

JN. W.

Inorganic Chemistry.

The Colour, Specific Gravity and Surface Tension of Hydrogen Peroxide. By WALTER SPRING (*Zeit. anorg. Chem.*, 1895, **8**, 424—433).—Pure hydrogen peroxide is prepared by concentrating a 9 per cent. solution on the water bath under diminished pressure until it contains 40—50 per cent. H_2O_2. This solution is treated with ether, the ethereal extract then treated with pure water, and the aqueous solution, after concentration, is again extracted with ether, the ether removed from the extract by distillation, and the residue distilled in a vacuum. The product, which contains 90 per cent. H_2O_2, is fractionally distilled, and the later fractions, which contain no water, are separated.

Pure dry hydrogen peroxide explodes with great violence, and precautions must be taken in distilling it. The specific gravity determined by weighing is 1·4996 at 15°; a control experiment in which the amount of hydrogen peroxide was determined by titration with permanganate gave sp. gr. = 1·4978. The surface tension was determined by measuring the height to which the liquid rises in a capillary tube, and comparing it with the height to which water rises in the same tube. The number obtained for hydrogen peroxide was 3·5374, and for water 7·750. The surface tension of hydrogen peroxide, however, increases very rapidly when mixed with small quantities of water.

Hydrogen peroxide has a blue colour. A column 1 metre long of 98 per cent. hydrogen peroxide has the same intensity of colour as a column of water 1·8 metres long. With a solution containing 80 grams of hydrogen peroxide to 100 c.c., the intensity of colour compared with that of pure water was found to be 1 : 1·62. The author points out that the ratio of the amounts of condensation of the oxygen atoms in hydrogen peroxide and water is 1·59. Thus the colour, which is characteristic of oxygen and ozone, is also characteristic of water, and, in a higher degree, of hydrogen peroxide.

E. C. R.

Gases of the Helium and Argon Type. By Bohuslav Brauner (*Chem. News*, 1895, **71**, 271).—Some time ago the author observed that cerite when treated with sulphuric acid and then with water yielded a gas showing the negative behaviour of nitrogen, but mixed with some hydrogen; the same mineral when heated in a vacuum alone, or with a sulphate, yields gases belonging to the helium and argon type; this was also noticed with several other Bohemian uranium ores. Pitchblende, from Příbram, shows a peculiar behaviour; with a feeble current, in a Geissler tube, with aluminium electrodes, it emits a blue-violet light, with a stronger current, a crimson light. With the spectroscope, the lines, D_3 and D_2 are seen together with 19 other lines or groups of lines; three of the lines belonging to hydrogen and one in the red to argon. After some time the helium lines disappear entirely, one by one, then the hydrogen lines go, and an extremely feeble, but characteristically, fluted hydrocarbon spectrum makes its appearance. The absorption of helium by aluminium proves its metallic character. D. A. L.

Helium in Cleveite. By Per T. Clève (*Compt. rend.*, 1895, **120**, 834).—Cleveite from Carlshuus, Norway, when heated with potassium hydrogen sulphate, yields a gas which, after being passed over red-hot copper and collected over concentrated aqueous potash, shows none of the lines of argon, but contains helium, and gives a spectrum consisting of the following lines: 6677, fairly strong; 5875·9, strong; 5048, fairly strong; 5016, strong; 4922, fairly strong; 4713·5, weaker. C. H. B.

Demonstration of the Presence of Argon in the Atmosphere. By Antoine Guntz (*Compt. rend.*, 1895, **120**, 777—778).—Magnesium combines somewhat slowly with nitrogen, and requires to be heated to a high temperature, whereas with lithium, prepared by electrolysis (Abstr., 1894, ii, 91), combination takes place readily below a dull red heat.

Nitrogen prepared from the air is enclosed in a glass tube with an iron dish containing lithium, and the latter is gently heated until the pressure in the tube is reduced to 10 mm. A further quantity of nitrogen is allowed to enter, and the heating continued, when it is found that the pressure of the residual gas is about 20 mm. If more nitrogen is admitted the pressure of the residual gas continually increases until at last the tube is practically full of argon. With pure nitrogen, on the contrary, there is no change in the residual pressure, no matter how often gas may be allowed to enter the tube.
C. H. B.

Free Hydrazine. By Cornelius A. Lobry de Bruyn (*Rec. Trav. Chim.*, 1894, **13**, 433—440).—The method of isolating hydroxylamine by acting on the hydrochloride with sodium methoxide is applicable to the isolation of hydrazine, as might be expected, since both the hydrate and its salts are more stable than those of the former base.

The hydrochloride is boiled with a methyl alcoholic solution of the methoxide for half an hour, no heat being evolved as with hydroxylamine, and the product, after removal of the sodium chloride, fractionated under reduced pressure. The tail fraction is then refractionated under ordinary pressure.

On the first attempt, a fraction was obtained containing more hydrazine (73 per cent.) than is present in either the hydrate or its methylic alcohol analogue, $N_2H_4,MeOH$. Free hydrazine was therefore present. In a second experiment, a fraction was obtained containing 82—84 per cent. of hydrazine, and boiling at 63—64° (110—111 mm.), and this, after fractional crystallisation, yielded crystals melting at $-1°$ to $-2°$, and containing 92 per cent. of free hydrazine. The hydrate melts below $-40°$.

The base thus obtained is extraordinarily hygroscopic, a fact sufficient to account for the low result of the analysis. It burns quietly, and, unlike hydroxylamine, does not explode on heating. When spread over a large surface, it oxidises quickly with evolution of heat, but it oxidises only slowly in mass. It is heavier than water, with which, as stated above, it combines with great avidity, and evolution of much heat. It dissolves sulphur crystals with evolution of heat to a reddish-brown liquid, having an odour resembling that of ammonium sulphide, from which sulphur is precipitated by water. The halogens combine violently with the base to form the free halogen acids; iodine, for example, oxidises it to nitrogen, being itself reduced to hydrogen iodide. The hypothetical diimide, NH:NH, is not apparently, formed, but this point is being investigated. The base is oxidised violently by solid potassium permanganate and dichromate, but the action is not so violent as with hydroxylamine, no ignition or explosion occurring. It dissolves various salts, potassium chloride, bromide, and nitrate, for instance. JN. W.

Action of Hydrogen on Amorphous Phosphorus. By HERBERT McLEOD (*Chem. News*, 1895, **71**, 245), and by GEORGE YOUNG (*ibid.*, 281).—McLeod has not recognised any action when hydrogen is passed over or left in contact with heated amorphous phosphorus. In the former case the escaping gas after passing through a water wash-bottle, fumed in air, but was not spontaneously inflammable, and after passage through a U-tube filled with wet glass beads, it neither fumed nor formed any copper phosphide in a solution of copper sulphate.

Young observed, in similar experiments, that with a rapid current of hydrogen and with the wash-bottle omitted, the issuing gas became inflammable, but that it was deprived of this property by passing it through a glass spiral, kept cool by water, just as readily as by the wash-bottle. D. A. L.

Reduction of Carbonic Anhydride at Ordinary Temperatures. By ADOLF LIEBEN (*Monatsh.*, 1895, **16**, 211—247).—According to Maly (*Annalen*, **135**, 118), carbonic anhydride is reduced to formic acid when treated with nascent hydrogen in the presence of a strong base. In this paper, a number of experiments are described which were undertaken with the object of confirming and extending Maly's work.

The author finds that when portions of sodium amalgam are added to water, through which a slow stream of carbonic anhydride is kept passing for several weeks, a considerable quantity of sodium formate, but of no other reduction product, is obtained.

Potassium and barium amalgam react in a similar manner, and the reduction appears to be independent of sunlight. Sodium amalgam also reduces carbonic anhydride in alcoholic solution, but the amount of sodium formate obtained is considerably less than when the aqueous solution is used. Small quantities of formic acid are also produced when the sodium amalgam reacts in the presence of mineral acids such as phosphoric and sulphuric. The amount of formic acid thus obtained appears to diminish with the amount of mineral acid which is present.

Zinc and aluminium in the presence of mineral acids have no appreciable reducing action on carbonic anhydride. Aluminium amalgam does not reduce an aqueous solution of the anhydride, but in the presence of alkaline salts, such as sodium hydrogen carbonate, sodium phosphate, potassium sulphate, and potassium tartrate, small quantities of formic acid are produced. When magnesium or platinised magnesium reacts on an aqueous solution of carbonic anhydride, no formic acid is obtained even in the presence of alkali salts. Platinised zinc also has no reducing action on an aqueous solution of the anhydride to which potassium or ammonium hydroxide has been added.

The author is unable to confirm Maly's statement that formic acid is produced when hot potassium hydroxide reacts with zinc and zinc carbonate. The author thinks his results may be summarised as follows.

1. Aqueous solutions of carbonic anhydride are not reduced by nascent hydrogen at the ordinary temperature.
2. Bicarbonates of the alkali or alkaline-earth metals (with the exception of magnesium), especially when freshly formed, are readily reduced by nascent hydrogen to the corresponding formates.
3. Formic acid is the only product of reduction, and sunlight plays no part in the process. J. J. S.

Sodium Hydrogen Sulphite. By REGINALD E. EVANS and CECIL H. DESCH (*Chem. News*, 1895, **71**, 248).—During the severe cold of last winter, a solution of sodium hydrogen sulphite, sp. gr. 1·290, deposited crystals of the composition $Na_2S_2O_5 + 7H_2O$, which tended to effloresce in the air, and had a faint odour of sulphurous anhydride. In warmer weather these crystals deliquesced and formed pearly white crystals of sodium pyrosulphite, $Na_2S_2O_5$, suspended in a solution of sodium hydrogen sulphite, sp. gr. 1·165. D. A. L.

Sodium Thiosulphate in Photography. By ALPHONSE SEYEWETZ and G. CHICANDARD (*Bull. Soc. Chim.*, 1895, [3], **13**, 11—18).—A study of the conditions which render photographs fixed by thiosulphate fugitive.

The fading is probably due to the action of products arising from the action, on the one hand, of mineral acids, and on the other hand, of alum, on the excess of thiosulphate. With excess of acid, the thiosulphate is decomposed in the well-known manner, but with excess of thiosulphate, secondary actions take place, resulting in the liberation of hydrogen sulphide; sodium sulphate and sulphite also appear to be formed. With alum, the effect is much the same.

Jn. W.

Compounds of Lithium Bromide and Chloride with $3H_2O$. By A. Bogorodski (*Chem. Centr.*, 1894, ii, 514; from *J. Russ. Chem. Soc.*, **26**, 209).—Crystals of $LiBr,3H_2O$ can be obtained by cooling to −40° a solution having the composition $LiBr + 4H_2O$; they decompose at 4°, $LiBr,2H_2O$ being formed. Crystals of $LiCl,3H_2O$ can be obtained from a solution having the composition $LiCl + 3{\cdot}3H_2O$, when it is cooled to −25°; they decompose at −15°. The temperatures at which the various hydrates decompose are:—

	$3H_2O$.	$2H_2O$.	$1H_2O$.
LiCl......	−15°	12·5°	98°
LiBr	4	44·0	159 (*not* 115°)
LiI	72	80·0	300

C. F. B.

Double compound of Lithium and Lead Iodides. By A. Bogorodski (*Chem. Centr.*, 1894, ii, 515; from *J. Russ. Chem. Soc.*, **26**, 216).—Small portions of lead iodide are introduced into a solution of lithium iodide, kept constantly stirred, at 140—150°, until yellow flakes begin to separate; water is then added until the precipitate formed is just permanent, the excess of water is evaporated, and the solution, now become clear again, is set aside. Yellow needles of $PbI_2,LiI + 5H_2O$ crystallise out; they should be pressed at a temperature above 72°, otherwise they may become contaminated with $LiI,3H_2O$. At 95° they lose $1H_2O$ and turn red; the other $4H_2O$ is lost only after long drying at 100°. In the air they take up $1H_2O$, and turn red; the crystals thus formed become yellow again at 88°.

C. F. B.

Solubility of Anhydrous Calcium Sulphate. By Alexei L. Potilizin (*Chem Centr.*, 1894, ii, 515; from *J. Russ. Chem. Soc.*, **26**, 170).—The solubility was determined by drying a weighed quantity of calcium sulphate for a given time at a given temperature, shaking it for a given time with a measured quantity of water, filtering, and evaporating a weighed quantity of the solution. The solubility varies (1) with the temperature and time of the drying; (2) to a certain extent, with the relative amount of the salt; and (3) with the time of shaking. In experiments with 1—2 grams of substance, the solubility is constant when the drying is done at temperatures between 96° and 200°; as the temperature of drying rises above 200°, the solubility decreases. With samples dried at the same temperature, the solubility increases somewhat when a larger quantity of the salt is taken, and a similar, but smaller, effect is produced when the salt is dried for a longer time. After a certain limit in the time of shaking, the solubility decreases; this is because hydrated salt separates out from the solution. These results are explained by supposing that there are two kinds of anhydrous calcium sulphate; α, which is formed between 120° and 200°, readily takes up $2H_2O$, and "sets" with water (plaster of Paris); β, which is ignited gypsum, or anhydrite, takes up water with difficulty and does not set. As a rule, mixtures of the two are obtained; but the lower the temperature and the shorter the time of drying, the less of the β variety is formed.

C. F. B.

Magnesium Fluorides and Silicates. By ANDRÉ DUBOIN (*Compt. rend.*, 1895, **120**, 678—681).—When dry magnesia is added in successive small quantities to potassium fluoride, fused at a bright red heat, it gradually dissolves, and if the mass is allowed to cool slowly, and is treated with water, the double fluoride, MgF_2,KF, is obtained in flattened, quadratic prisms. The same product is obtained by the action of potassium hydrofluoride on magnesia, and is attacked by both sulphuric and hydrochloric acids; sp. gr. at 0° = 2·8.

When magnesia is added in somewhat large quantity, another product, $MgF_2,2KF$, is obtained in addition to the preceding compound. Its sp. gr. at 0° is 2·7, and it is attacked by sulphuric and hydrochloric acids.

Analogous and well crystallised products in which the fluorine is partially replaced by chlorine are obtained by fusing the preceding crude products with potassium chloride.

No silicate is obtained by adding silica to the fused potassium fluoride containing magnesia, even when the product is afterwards fused with potassium chloride. If, however, one part of magnesia and 4 parts of silica are dissolved in fused potassium fluoride and the product is afterwards fused with potassium chloride and kept at a red heat for about three days, the compound, $MgO,K_2O,3SiO_2$, is obtained in hexagonal crystals, with a negative axis, and flattened parallel with the base. Its sp. gr. at 0° is 2·55, and it is readily attacked by acids. Another silicate containing both chlorine and fluorine is produced at the same time in highly birefractive flattened crystals with rectangular forms which show longitudinal extinction.

C. H. B.

Alloys of definite Composition. By HENRI L. LE CHATELIER (*Compt. rend.*, 1895, **120**, 835—837).—The alloy, $SnCu_3$, is obtained in white, crystalline lamellæ, by fusing copper with an excess of tin and treating the product with cold concentrated hydrochloric acid. It is not attacked by acids, and is one of the definite compounds indicated by the physical researches of several previous observers.

The compound, Zn_2Cu, is obtained by fusing copper with excess of zinc, and treating the product with very dilute hydrochloric acid or, better, a paste of lead chloride. It forms small, white needles, and its composition agrees with that deduced by Laurie from his observations on electromotive forces.

The compound, AlCu, is obtained in like manner; the crude product being treated with very dilute hydrochloric acid, or very dilute potash solution. It forms white crystals, which acquire a bronze colour if subjected too long to the action of the acid or alkali.

A zinc chromium alloy is obtained in hexagonal lamellæ by fusing a mixture of chromic chloride and alkali chlorides with excess of zinc and treating the product with dilute hydrochloric acid, or better a paste of lead chloride.

All these alloys are hard and brittle. C. H. B.

Cerite Metals. By PAUL SCHÜTZENBERGER (*Compt. rend.*, 1895, **120**, 663—668).—Purified cerium sulphate prepared from cerite was converted into the oxalate and then into the nitrate, and the latter was fused with potassium nitrate according to Debray's method. The yellow oxide thus obtained was again converted successively into sulphate, oxalate, and nitrate, and the latter was again fused with potassium nitrate. Cerium oxide prepared in this way is almost white and is quite free from didymium. It was then converted into ceric sulphate by the action of concentrated sulphuric acid, and this was changed into the cerous salt by heating at dull redness. After purification by repeated crystallisations from water, the cerous salt was heated at 440° in a current of dry air.

The sulphuric acid in cerous sulphate cannot be accurately estimated by precipitation with barium chloride in presence of hydrochloric acid. If, however, a hot solution is precipitated with pure sodium hydroxide, filtered, and the filtrate acidified with hydrochloric acid, and precipitated with a *very slight* excess of barium chloride, the barium sulphate obtained is pure. The small quantity of sulphuric acid precipitated with the cerous oxide is removed by redissolving the latter in hydrochloric acid, again precipitating with alkali, and treating the filtrate with hydrochloric acid and barium chloride.

Analyses of cerous sulphate made in this way gave 139·45 for the atomic weight of cerium.

Brauner's method of converting the sulphate into oxide by strongly heating, gave results that varied with the temperature. The values obtained by the synthesis of cerous sulphate from the oxide were also unsatisfactory and varied from 139 to 143 according to the temperature at which the oxide had previously been heated.

Direct experiment showed that cerium dioxide is slightly oxidised by the air.

The cerium dioxide obtained by two or three successive fusions with potassium nitrate is free from lanthanum and didymium, but if it is converted into cerous sulphate and the latter is subjected to fractional crystallisation, the atomic weight of cerium obtained by converting the cerous sulphate into oxide by strongly heating, gradually decreases with successive fractions. In the examples quoted the decrease is from 139·4 to 135·2, and it is clear that the cerium dioxide obtained by Debray's method must contain metals other than cerium.

C. H. B.

Cerium. By BOHUSLAV BRAUNER (*Chem. News*, 1895, **71**, 283—285).—The author points out that he sometime ago discovered the compound character of ordinary cerium, mentioned by Schützenberger (preceding abstract), and is still investigating cerium. He confirms Mendeléeff's view as to the composition of the sulphate, $Ce_2O_3,3SO_3 + Ce_2O_4,4SO_3 + 24H_2O$, from the results of analysis and synthesis, as well as from the fact that similar salts may be prepared, in which other trivalent earth-metals replace the trivalent cerium, such for example as $La_2O_3,3SO_3 + Ce_2O_4,4SO_3 + 24H_2O$.

Ceric hydroxide exists in two modifications, one insoluble in cold hydrochloric acid, the other soluble giving a brownish-yellow solution of the tetrachloride which decomposes with the evolution of chlorine, even at $-18°$.

Cerium can be more or less completely split up into its constituents by various means. Fractionating ceric oxide by solution in sulphuric acid results in a residue insoluble in boiling concentrated sulphuric acid which can be dissolved by fusion with potassium hydrogen sulphate, or by boiling with hydrochloric acid and potassium iodide; the oxalate of this leaves on ignition a rose-brown (dark salmon-coloured) oxide of an element called by the author "*meta-cerium.*" Other means employed were partial reduction of ceric oxide in hydrogen and extraction of the products; fractional precipitation with oxalic acid; fractional crystallisation of the sulphate and precipitation of the mother liquor by alcohol; fractional crystallisation of ceric ammonium nitrate; fractional crystallisation of cerous ammonium nitrate, Mendeléeff's method; accumulating the new earth in the mother liquors from the precipitation of cerium as basic nitrate or sulphate, and obtaining it from them by combining Debray's method with one of the above methods. In the spark spectra of different fractions of cerium some lines are common to cerium and meta-cerium, whilst other lines are characteristic for each of them.

A re-determination of the atomic weight of cerium has been made, based on the analysis of the normal oxalate by Gibbs' method, using *old* potassium permanganate of an invariable standard and carefully ascertaining and correcting for the active oxygen contained in the ceric oxide over and above Ce_2O_3; as a result the numbers 139·91, 139·72 and 140·01 have been obtained, of which the author prefers the last.

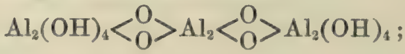
The oxidation of colourless cerous to yellow ceric salts by means of permanganate, $3Ce_2O_3 + 2KMnO_4 + H_2O + Aq = 2KHO + 2MnO_2 + 3Ce_2O_4 + Aq$, is used by the author for the volumetric estimation of cerium, the excess of permanganate is estimated in the filtrate after the removal of the hydrated oxides. In acid solutions, the yellow ceric colour interferes with the perception of the end reaction, but in alkaline solution excellent results are obtained and the method is invaluable for determining trivalent cerium in the presence of tetravalent cerium and of cerium in any form (tetravalent may first be reduced by sulphurous acid) in the presence of other non-oxidisable earths.

The communication concludes with some comments on the position of the rare earth elements in the periodic system and the note that "the valency of the rare earth elements increases with increasing atomic weight." D. A. L.

Aluminium Compounds. By Ernest Schlumberger (*Bull. Soc. Chim.*, 1895, [3], **13**, 41—65).—The precipitate formed when aluminium sulphate is exactly neutralised with alkali consists of a *basic sulphate* having the composition $2Al_2O_3,SO_3,7H_2O$, and the probable constitution, $[Al_2(OH)_5]_2SO_4,2H_2O$. It is stable only in presence of alkali sulphates, and is partially dissolved by water. The dry substance loses $2\mathrm{H_2O}$ at 130°, but is otherwise stable. It is soluble in cold acetic acid, but is reprecipitated on boiling, and redissolves on cooling, in this resembling the ordinary aluminium mordanting solution, the essential constituent of which appears to be an acetate of this sulphate. The same sulphate is precipitated when sodium aluminate is neutralised with alum, or when a solution of alum, to which alkali has been added until a slight permanent precipitate is formed, is boiled, or when a solution of aluminium acetate is boiled with alkali sulphates.

An analogous *basic carbonate*, $[\mathrm{Al_2(OH)_5}]_2\mathrm{CO_3,H_2O}$, is precipitated by large excess of sodium carbonate from aluminium salts of monobasic acids, or by carbonic anhydride from cold solutions of alkali aluminates. The composition of the salt varies with the basicity of the acid, a fact which explains the discordant results obtained by previous authors.

Various hydroxides were prepared. The normal hydroxide, $\mathrm{Al(OH)_3}$, could not be obtained in a pure condition, as on removal of the alkali salts, it lost, to a large extent, its solubility in acids. The product thus obtained was in fact, a mixture of a soluble, probably normal hydroxide, and an insoluble, colloïdal form. These may be separated by means of dilute hydrochloric acid or alkali, and the latter form may be readily prepared by boiling aluminium salts with large excess of alkali. The ordinary hydroxide precipitated in estimating alumina usually contains a large amount of the colloïdal hydroxide, especially if the solution has been boiled to expel ammonia; this is objectionable, as the colloïd tends to become gelatinous, or even soluble, after the removal of the alkali salts. The composition of these hydroxides is not particularly definite. The chief is *metatrialuminium hydroxide*, $\mathrm{Al_6O_{14}H_{10}}$, possibly



$$\mathrm{Al_2(OH)_4}<\substack{\mathrm{O}\\ \mathrm{O}}>\mathrm{Al_2}<\substack{\mathrm{O}\\ \mathrm{O}}>\mathrm{Al_2(OH)_4}\,;$$

this forms white, translucent clots, and is very hygroscopic. It swells up in cold, concentrated mineral acids. but does not dissolve readily until heated, when it forms normal aluminium salts. On the other hand, it dissolves with great ease in cold, dilute hydrochloric acid to a viscous, opalescent, but homogeneous liquid, which passes through filter paper. This liquid, which is acid and astringent, appears to coagulate when concentrated, and the dried coagulum forms a gummy mass of the composition, $\mathrm{Al_6O_{14}H_{10},HCl}$ When the solution of this *hydrochloride* is dialysed, normal aluminium choride is eliminated, and the original basic hydroxide remains. A corresponding *nitrate*, and *acetate* were prepared, and a *sulphate* appears to exist. Other hydroxides were prepared containing a larger percentage of the base, but probably of the same type. The colloïdal hydroxides do not appear to act as mordants, and it is probable that the deteriorating effect of alkalis or even steam on the mordanting power of alumina is due to their formation. JN. W.

Properties of Nickel and Cobalt Salts. By LUCIEN L. DE KONINCK (*Compt. rend.*, 1895, **120**, 735—737).—The author claims priority for himself, Lecrenier, and Ledent, with regard to a detailed description (*Traité de Chemie analytique minérale*, Liege, 1894) of the behaviour of nickel and cobalt sulphides with alkali sulphides. (See Villiers, this vol., ii, 228—247.) C. H. B.

Dichromates of the Heavy Metals. By GERHARD KRÜSS and OSKAR UNGER (*Zeit. anorg. Chem.*, 1895, **8**, 452—463).—The dichromates of the heavy metals cannot be obtained in a crystalline form, except a lead dichromate described by Preis and Rayman (*Ber.*, 1880, **13**, 340), which is obtained by dissolving lead chromate in hot concentrated chromic acid, and crystallises in small, interlacing needles, and a copper dichromate $CuCr_2O_7,2H_2O$, which separates in undefined crystals, and has been described by Freese (*Ann. Phys. Chem.*, **140**, 87) and Balbiano (*Gazzetta*, **18**, 195).

The crystalline double salts of dichromates of the heavy metals and alkalis described below, are only obtained under special conditions, and decompose into their components when recrystallised.

Cobalt ammonium dichromate, $CoCr_2O_7,(NH_4)_2Cr_2O_7 + 2H_2O$, is obtained by dissolving molecular proportions of ammonium dichromate and cobalt nitrate in the smallest possible quantity of hot water, and allowing the solution to cool slowly. After the first crystallisation has taken place, the viscid mother liquor is allowed to remain in a vacuum for three weeks when the salt separates in black, lustrous plates. It is very slightly hygroscopic, dissolves in water with difficulty, and loses its water of crystallisation completely at 105°.

Cadmium potassium dichromate, $CdCr_2O_7,K_2Cr_2O_7 + 2H_2O$, is obtained by dissolving the precipitate of basic chromate, prepared from potassium chromate and cadmium nitrate in chromic acid, and then concentrating the solution on the water bath. It crystallises in bright, brownish-red, four-sided prisms, is slightly hygroscopic, and gives up its water of crystallisation and darkens at 105°.

Copper ammonium dichromate, $2CuCr_2O_7,3(NH_4)_2Cr_2O_7 + 6H_2O$, is easily obtained by adding copper dichromate to a hot concentrated solution of ammonium dichromate. It crystallises in long, dark brown needles, loses its water of crystallisation, and is decomposed at 100°, and burns violently with evolution of flame and formation of chromic oxide.

When a concentrated solution of a dichromate of a heavy metal, prepared by dissolving the hydroxide in concentrated chromic acid, is mixed with a hot solution of mercuric chloride, and the mixture allowed to cool, most of the mercuric chloride separates unchanged. The mother liquor, which still contains mercury when evaporated to a syrup, partially crystallises in long, colourless needles. If, however, mercury cyanide is employed in place of the chloride well characterised double salts are obtained.

Silver dichromate mercury cyanide, $Ag_2Cr_2O_7Hg(CN)_2$, has already been described by Darby (*Annalen*, 1848, **65**, 205), who prepared it by adding silver nitrate to the salt $3Hg(CN)_2,2K_2CrO_4$. It is most easily obtained by adding a solution of potassium dichromate to a hot solution of silver nitrate and mercury cyanide until a faint, permanent precipitate is formed. It crystallises in slender, radiating prisms, having a beautiful, golden-red colour and a characteristic iridescence. When heated, it explodes violently, with the formation of chromic oxide, and metallic silver and mercury. The authors were unable to obtain the corresponding thallium salt.

The following double salts are not so easily obtained, as the chromic acid decomposes the mercury cyanide, even at the ordinary temperature. The best results are obtained by avoiding an excess of chromic acid, and concentrating the solutions at 45° in a current of dry air. The salts are easily recrystallised, and when pure can be boiled with water without decomposition.

Cobalt dichromate mercury cyanide, $CoCr_2O_7,2Hg(CN)_2 + 7H_2O$, is obtained by mixing hot concentrated solutions of cobalt nitrate, ammonium dichromate, and mercury cyanide. It crystallises in brownish-red, transparent tablets having a diamond lustre. When exposed to the air, it gradually gives up its water of crystallisation. The anhydrous salt is dark brownish-red. When heated at 300°, it explodes violently, with the formation of a thick cloud of cobalt and chromium oxides and deposition of mercury.

Nickel dichromate mercury cyanide, prepared in a similar manner, crystallises with $7H_2O$ in dirty green concretions.

Cadmium dichromate mercury cyanide is obtained by carefully evaporating a solution of cadmium dichromate and mercury cyanide. It crystallises with $7H_2O$ in red, lustrous tablets, is not hygroscopic, detonates on heating, and resembles the cobalt salt.

Zinc dichromate mercury cyanide, prepared in a similar manner to the preceding salt, crystallises with $7H_2O$ in large, rhombic red tablets, gives up its water of crystallisation and decomposes at 100°, and detonates at a higher temperature.

Copper dichromate mercury cyanide, $CuCr_2O_7,Hg(CN)_2 + 5H_2O$, is obtained in a similar manner to the above salts; the yield, however, is very small. It separates in greenish-brown nodules, is easily soluble in water, and decomposes at 100°. E. C. R.

Atomic Weight of Molybdenum. By KARL SEUBERT and WILLIAM POLLARD (*Zeit. anorg. Chem.*, 1895, **8**, 434—451).—The method is based on the acidimetric determination of molybdic acid, previously described by the author (this vol., ii, 331). The molybdic acid is purified as follows:—It is dissolved in ammonia, and the solution evaporated to dryness with the addition of a few drops of ammonium sulphide. The residue is taken up with water and ammonia, filtered, and the filtrate crystallised. After two recrystallisations, the salt is decomposed with excess of nitric acid, and evaporated to dryness. The molybdic acid is then washed with water, strongly heated in a platinum dish, and finally sublimed in a current of oxygen. A weighed quantity of the molybdic acid, previously heated at 110°, is dissolved in a weighed quantity of standard sodium hydroxide solution, a slight excess being employed, and heated on the water bath until it is completely dissolved. Phenolphthaleïn is then added, and a slight excess of standard sulphuric acid, and the solution boiled for 10 minutes to expel carbonic anhydride. The excess of acid in the cold solution is then determined by the addition of standard lime water. At the same time the sulphuric acid is titrated against the lime water, and a blank experiment is performed. The mean of 11 experiments gave Mo = 95·722 when H = 1, or when the weights are corrected to vacuum Mo = 95·729.

As a control on the above method the authors have also determined the atomic weight by the reduction of molybdic acid to molybdenum in a current of pure hydrogen. A weighed quantity of the acid in a platinum boat is heated cautiously in a current of hydrogen until it is converted into the dioxide. The temperature is then gradually increased to a bright yellow, and finally the resulting molybdenum is allowed to cool in a current of hydrogen and weighed. The mean of five experiments gave Mo = 95·772, or when corrected to vacuum Mo = 95·735 (O = 15·96). E. C. R.

Chromates of the Rare Earths. Chromates of Thorium. By CHASE PALMER (*Amer. Chem. J.*, 1895, **17**, 374—379).—When thorium hydroxide is gradually added to a solution of pure chromic anhydride in water, the hydroxide is dissolved but *thorium chromate*,

$$Th(CrO_4)_2,H_2O,$$

soon separates, first as a flocculent and then a crystalline, orange precipitate. The precipitate forms more quickly at 90°, and only loses its water of crystallisation at 180°. If the solution is evaporated over sulphuric acid in a vacuum, the salt crystallises with $3H_2O$ in orange scales. These lose $2H_2O$ at 120°, and the third molecule only at 180°. The salt is also precipitated (immediately in hot solutions, slowly in cold) when thorium nitrate and potassium dichromate are mixed. If thorium nitrate (1 mol.) is treated with potassium chromate, a *basic chromate*, $Th(OH)_2CrO_4$, separates as a golden-yellow precipitate, the solution becoming red from formation of potassium dichromate. If this precipitate is left in contact with the solution, it is gradually changed into the orange normal salt, with reconversion of the solution into yellow potassium chromate. Thorium chromate is readily soluble in hydrochloric acid and in ammonium carbonate, and at 22° one part is soluble in 284 parts of water. The anhydrous salt is of an ochreous-yellow colour, and decomposes at a dull red heat.

The author is now investigating the chromates of zirconium, of which he has obtained a basic salt. L. T. T.

Platinous Chloride and its Compounds. By LÉON PIGEON (*Compt. rend.*, 1895, **120**, 681—682).—Chloroplatinic acid, H_2PtCl_6, is exactly neutralised with barium carbonate, and the solution is mixed with barium dithionate in exactly molecular proportion, previously dissolved in three times its weight of water, and the mixture is heated on a water bath for 24 hours. Platinous chloride, hydrochloric acid, and barium sulphate are formed, and the filtered liquid contains only the first two products. Since platinous chloride will not crystallise, it is best converted into the double potassium compound by addition of potassium chloride, and any traces of platinic chloride remaining unreduced are of course precipitated. C. H. B.

Mineralogical Chemistry.

Aluminosilicates. By STANISLAUS J. THUGUTT (*Jahrb. f. Min.*, 1895, *Beil. Band*, **9**, 554—624; compare Abstr., 1893, ii, 421).—Numerous experiments were made on various aluminous silicates, which show that the aluminium plays different *rôles* in the molecule; attempts were also made to arrive at the constitution of the minerals treated. The experiments consisted in the prolonged digestion of the material with dilute solutions (usually 1—2 per cent. potassium carbonate) at temperatures of about 200°.

The artificial natronnepheline hydrate, $4Na_2Al_2Si_2O_8,5H_2O$, on such digestion, splits up into a potassiumnatrolite, $K_2Al_2Si_3O_{10},3H_2O$, and sodium aluminate, $Na_2Al_2O_4$; its constitution is, therefore, represented as $4(2Na_2Al_2Si_3O_{10},Na_2Al_2O_4),15H_2O$; by digestion with pure water, natrolite and kaolin are obtained. On fusing the last material, soda-anorthite (natronanorthit, $Na_2Al_2Si_3O_8$), is obtained; this gives the same results on digestion as before, and a similar constitution is given. Artificial kaliophilite (kalinephelin, $K_2Al_2Si_2O_8 = 2K_2Al_2Si_3O_{10},K_2Al_2O_4$), is converted by the same treatment into a potash mica and free potash: as potash mica has the same empirical formula as this substance, it is probably also of the same constitution, namely, $K_2H_2Al_4Si_6O_{20},H_2Al_2O_4$ [$= (K,H)_2Al_2Si_2O_8$], this agrees with the more basic potash-micas, whilst in the more acid (Tschermak's phengite) the group $H_2Al_2O_4$ is omitted.

According to Lemberg the members of the sodalite group correspond with natronnepheline hydrate in having a sodium salt in place of water; this is confirmed by the action of the potassium carbonate solution being the same in both. The constitution of sodalite is given as $8Na_2Al_2Si_3O_{10},4Na_2Al_2O_4,8NaCl$. The action of pure water on sodalite gives rise to natrolite, sodium aluminate, sodium chloride, and some kaolin; from these various products, sodalite can be reconstructed. Owing to the somewhat different behaviour of artificial and various natural specimens of sodalite, when digested with calcium chloride solution, three metameric varieties of this mineral are distinguished. The reactions with nepheline are much the same as those of sodalite, and the similar constitutional formula $8Na_2Al_2Si_3O_{10},4Na_2Al_2O_4,3K_2Al_2Si_3O_{10}$ is deduced. Kaolin, with dilute caustic potash solution, gives potassium natrolite and potassium aluminate; hence its formula, $2H_2Al_2Si_3O_{10},H_2Al_2O_4,3H_2O$. Sanidine, on the same grounds, is given as $2K_2Al_4Si_3O_{10},K_2Al_2O_4,12SiO_2$.

The constitutions of natrolite, leucite, and analcime are also discussed. Experiments were made on the influence of the concentration of the solutions used; in general with concentrated solutions only substitution occurred, whilst with dilute there was also decomposition. The application of the results are discussed at length in connection with geological processes and pseudomorphism, especially as regards the alteration of nepheline; from the constitutional formula above given for this mineral, it is seen that natrolite, hydrargillite or diaspore, and mica, in various combinations, could be derived. The hydronephelite derived from nepheline is considered to be a mixture of natrolite and hydrargillite. L. J. S.

Physiological Chemistry.

Heat Value of Proteïds in the Organism. By Camille Matignon (*Bull. Soc. Chim.*, 1894, [3], **11**, 568—571).—The physiological heat value of proteïd material is less than the physical heat value, chiefly because in the body combustion is incomplete, and the nitrogen leaves it as urea and uric acid. The heat value of uric acid and its allies is calculated from equations. If the nitrogen leaves the body as urea, the physiological heat value of the proteïd is five-sixths the physical heat value; if as uric acid, the proportion is 3 to 4. Such considerations, however, do not take into account the synthetical processes which no doubt occur in the body in the formation of both substances. W. D. H.

Nitrogenous Metabolism. By Erwin Voit and Alexander Korkunoff (*Zeit. Biol.*, 1895, **32**, 58—175).—This is an account of a series of experiments on dogs, carried out in the well-known manner of the Munich School, on the question particularly of the smallest amount of nitrogenous food compatible with a condition of equilibrium. As the paper does not discuss the question from the point of view of the nitrogenous metabolism in human beings, it practically adds very little to our knowledge of the much debated question whether the nitrogenous requirement of a man is as great as represented by the earlier experiments of Voit.

The bulk of the present paper is concerned with a discussion of the experiments recorded; the experiments themselves may be stated very shortly.

The dog was fed on a known diet, and its excreta examined. The amount of nitrogen in the food was varied. In some cases the amount was found in which there was no difference in the nitrogenous intake and output. In the majority of instances, however, this was not exactly the case, but a certain amount of nitrogenous food was found to lead to a loss of a small amount of nitrogen from the body; a small increase led to a gain of some nitrogen to the body; the physiological proteïd minimum, that is, the amount just sufficient to maintain equilibrium, is between the two. The experiments are in three categories, the diet in which consisted respectively of (1) proteïd alone, (2) proteïd *plus* fat, and (3) proteïd *plus* carbohydrate. The following table gives some of the main results, in which it will be seen that the physiological proteïd minimum is largely diminished in a mixed diet.

Physiological Proteïd Minimum in Grams.

Dog.	1. Proteïd alone.	2. Proteïd *plus* fat.	3. Proteïd *plus* carbohydrate.
1	12·04	7·63	>4·91
2	>6·8 <12·87	>5·72	5·0
3	>9·62	>6·93	5·11
4	>12·56 <30·14	5·12	<4·47

W. D. H.

The Liver and Metabolism of Carbohydrates. By Friedel Pick (*Chem. Centr.*, 1894, ii, 55—56; from *Arch. exp. Path. Pharm.*, **33**, 305—317).—The liver substance was destroyed by injection of weak acid into the bile duct. This causes the disappearance of glycogen, but no glycosuria. Breathing of carbonic oxide produces glycosuria when glycogen is still present, but in those animals in which it has been made to disappear there is no glycosuria. Thus the sugar in the urine comes from the hepatic glycogen.

The phenomena of phloridzin diabetes have suggested that the sugar in the urine comes not from glycogen, but from proteïd. The present method of experiment is a means of determining whether the integrity of the liver is essential for its production, and it was found that it is not. In phloridzin diabetes, the source of the sugar is therefore outside the liver. The formation of glycuronic acid and of urochloralic acid from chloral also occurs after the destruction of the liver substance. W. D. H.

Sugar and Cells. By Max Cremer (*Zeit. Biol.*, 1895, **32**, 49—57).—The bulk of the paper is speculative. It insists on the importance of experiments on yeast and yeast glycogen in order to ascertain what varieties of sugar can form glycogen. The statement that sugars which undergo the alcoholic fermentation with yeast are also true formers of glycogen, and that those which do not ferment are not, is too wide; it does not include the formation of glycogen from mannose and galactose. That those sugars which ferment most easily go into the urine with the greatest difficulty, and those which do not ferment go with the greatest ease, is stated to be true. The relationship of glycogen to fat formation is also discussed, but no very positive statement made. W. D. H.

Glycolysis in Blood and Tissues. By WILHELM SPITZER (*Pflüger's Archiv.*, 1895, **60**, 303—339).—The power that the blood possesses of destroying sugar has been the subject of numerous recent researches. The present research shows that this power is possessed by the blood drawn without admixture, and also by defibrinated, laky, and oxalated blood. This is a property possessed not by the serum, but by the corpuscles. Glycolysis, moreover, is not a vital process, but the blood corpuscles contain substances which possess the power in question. Other tissues are also glycolytic; in fact, glycolysis is a property common to all cells. The disappearance of sugar is due to oxidation; sugar is not destroyed in blood or tissues free from oxygen. The action does not appear to be due to any enzyme, but is the result of the activity of molecular oxygen. A large amount of the paper is devoted to comparing this oxidation with that produced by hydrogen peroxide and other inorganic and organic oxidising agents. W. D. H.

Thiocyanic acid in the Juices of the Stomach. By MARCELLUS NENCKI (*Ber.*, 1895, **28**, 1318—1320).—Thiocyanic acid is contained in the juices of the stomach (free from saliva) to the extent of 5 milligrams per litre. It is not contained in muscle or liver; with blood a doubtful result was obtained. C. F. B.

Paramucin. By KATHARINA MITJUKOFF (*Archiv. f. Gynäkol.*, 1895, **49**, Heft 2; *Inaug. Diss.*, Berlin).—The colloïd material formed in ovarian cysts may be of two kinds: (1) colloïd which after boiling with acids reduces Fehling's solution, and is generally combined with proteïd matter, as metalbumin or paralbumin; the chief constituent of both these substances was termed pseudomucin by Hammarsten. (2) Colloïd which reduces Fehling's solution without treatment with acid. This is termed paramucin in the present research. It is a jelly-like material, which unites with hydrochloric acid, and was thus separated from the contents of the cysts. By boiling with this acid, it is destroyed, forming a humus-like material. By decomposition with alkalis, it yields an albuminate, an albumose, and a carbohydrate. The carbohydrate does not form an osazone, neither does it ferment with yeast. W. D. H.

Visual Purple. By WILLIE KÜHNE (*Zeit. Biol.*, 1895, **32**, 21—28).—Bile is the best solvent of the visual purple. To obtain a solution free from hæmoglobin is difficult in most animals, although it can be accomplished with frogs' eyes. It is, however, now possible to obtain a separation of visual purple from hæmoglobin should both be in solution. The solution in bile salts is saturated with magnesium sulphate; this precipitates the visual purple, hæmoglobin remaining in solution. Saturation with ammonium sulphate precipitates both pigments. After the purple has been fixed in the retina by means of alum, it is comparatively insoluble; it can, however, be dissolved by a

10 per cent. solution of sodium chloride in bile, and is by this method also obtained free from hæmoglobin.

The best method of preserving the purple is to saturate its solution with sodium chloride. This produces a slight cloudiness, but no precipitation of the pigment itself. W. D. H.

Action of Intravenous Injection of Sodium Chloride Solution on the Composition of Blood and Lymph. By WELHELM COHNSTEIN (*Pflüger's Archiv.*, 1895, **60**, 291—295).—Further experiments are recorded, which, performed in a somewhat different way, support the author's previously expressed views (compare this vol., ii, 173). W. D. H.

Abnormal Excretion of Sulphur in a Dog. By WILLIAM J. S. JEROME (*Pflüger's Archiv.*, 1895, **60**, 233—249).—The manner of excretion of sulphur varies under many circumstances, disease, drugs, hunger, time of day, kind of food, kind of animal, &c. The present extended series of experiments were all made on one dog, and show that during a normal period 66·5 per cent. of the total sulphur was excreted as sulphuric acid; this rose to 68·4 per cent. on the administration of carbaminthioglycollic acid, and fell to 50·4 on the administration of ethylic sulphide. The drugs produced not only an effect while being given, but the effect lasted some time after; calomel and jalap produced a rise to 70 per cent. Simultaneous observations on the nitrogen excreted showed that the differences are absolute, and not merely relative to the amount of proteïd metabolism. W. D. H.

Physiological Action of Hydrohydrastininum Hydrochloride. By WILLIAM KRAMM (*Chem. Centr.*, 1894, ii, 59—60; *Dissert.*, Berlin).—Hydrohydrastinine causes reflexly clonic, sometimes tetanic, convulsions; it is not toxic to the heart, but increases the rate and pressure of the blood flow. This is well marked after the fall of pressure accompanying vagus stimulation. Before convulsions set in, the drug causes dyspnœa. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

The Time of Trehalose Formation in Plants. By EMIL E. BOURQUELOT (*Chem. Centr.*, 1894, ii, 482; from *Bull. de la Soc. mycolog. de France*, **9**, 11).—In species the development of which proceeds uninterruptedly from the germination of the spore, trehalose is formed in appreciable quantity only at the time of spore formation, which, for that matter, occurs very early in the case of these species. In such species as at certain times form a sclerotium, in order to await more favourable conditions for fructification, the state of matters is more complicated: some behave like those already mentioned; in others the sclerotium develops trehalose even during the period of stagnation. The trehalose is formed from a reserve substance contained in the tissues, probably from a carbohydrate analogous to dextrin.

C. F. B.

Variations in the Sugars during the Germination of Barley. By PAUL PETIT (*Compt. rend.*, 1895, **120**, 687—689).—Experiments with two lots of barley show that during steeping the variations in the proportions of reducing sugar are trifling, whilst the quantity of saccharose continually increases. The results were as follows in milligrams of sugar per 1000 barley grains.

	Original.	1st day.	2nd day.	3rd day.	4th day.	5th day.
Reducing sugar (as glucose)	24	29	30	31	32	39
Saccharose	214·7	230	260·3	307	384·8	406·6

The following results were obtained during germination.

	On malting floor.			In Saladin's apparatus.		
	Glucose.	Saccharose.	Diastatic power.	Glucose.	Saccharose.	Diastatic power.
1st day	48	413	0	57	403	0
2nd „	86	420	0	84	435	0
3rd „	187	426	0	172	457	0
4th „	269	433	564	234	462	525
5th „	319	437	225	287	464	195
6th „	363	453	143	341	469	125
7th „	394	476	83	379	489	66
8th „	417	542	34	409	553	31
9th „ ...	402	642	31	397	651	28
After drying.	330	782	150	324	826	100

There would seem to be a relation between the quantity of reducing sugar and the activity of respiration. There is also a relation between the quantities of reducing sugar and of saccharose in the barley during its germination. Pneumatic malting gives more regular respiration, and yields a malt richer in diastase even after drying.

C. H. B.

The Sugar of the Agave Americana. By WINTHROP E. STONE and DUMONT LOTZ (*Amer. Chem. J.*, 1895, **17**, 368—371).—In 1892 Michaud and Tristan stated (Abstr., 1893, i, 94) that they had obtained a new crystalline and inactive sugar from the *Agave Americana*, to which they gave the name agavose. The authors have carefully reinvestigated this matter, but find that the only crystallisable sugar in the *Agave* juice is saccharose. The non-activity of the sugar obtained by Michaud and Tristan must have been due to the impurity of their specimen; the juice contains some invert sugar. The carefully purified sugar obtained by the authors had a specific rotation $[\alpha]_D =$

+66·3°, and showed all the characteristics and reactions of saccharose. On inversion, it yielded invert sugar having the specific rotation $[\alpha]_D = -20·6°$. L. T. T.

The Organic Bases of some Agricultural Seeds, Oil-cakes, Tubers, and of some Seedlings. By Ernst Schulze, S. Frankfurt, and Ernst Winterstein (*Landw. Versuchs-Stat.*, 1895, **46**, 23—77).—Choline occurs in the seeds of *Vicia sativa*, *Pisum sativum*, and *Cannabis sativa*, in seedlings of *Triticum vulg.* and *Arachis hypogœa*, in cocoa-nut palm and sesame cake, in potatoes, in etiolated seedlings of *Vicia sat.*, *Lupinus lut.* and *alb.*, *Soja hispida*, and *Cucurbita pepo*, and in malt sprouts. Choline is accompanied by betaine in the sprouts of wheat and malt. Trigonelline was found in the seeds of peas, hemp, and oats (compare E. Jahns, Abstr., 1886, 85; 1891, 1520; R. Böhm, *Arch. exper. Path. u. Pharmakol*, **19**, 60 and 87; Griess and Harrow, Trans., 1885, 298; Kunz, *Arch. Pharm.*, **223**, 701; Brieger, *Zeit. physiol. Chem.*, **11**, 184, and v. Lippmann, Abstr., 1888, 314).

As regards the possibility of the choline having been produced from lecithin during the treatment of the extracts, this would only be possible in the case of alcoholic extracts, since lecithin is insoluble in water. And in the case of alcoholic extracts, the evidence is against such an assumption. No other compound is as yet known to occur in plants which yields choline as a decomposition product.

Betaine had previously been found in cotton seed (Ritthausen and Weger, *J. pr. Chem.*, [2], **20**, 32) in the seeds of *Artemisia Cina* (Jahns, Abstr., 1893, ii, 485) and of *Chenopodium album* (Halpern, *Ber. physiol. Lab. Vesuchsaust. d. Landw. Inst. Univ.*, Halle, Heft. 11, 72), and in the leaves of *Solanum tuberosum* (Schütte, *Arch. Pharm.*, **229**, 492). In the plants examined by the authors, betaine probably occurs ready formed, except possibly in the case of vetch seeds (compare Scheibler, *Ber.*, **3**, 159, and Liebreich, *ibid.*, 161).

Trigonelline is only known to occur in *Trigonella fœnum græcum* (Jahns, *loc. cit.*), besides the plants given above.

Choline alone of the bases isolated is known to act poisonously; stachydrin has not yet been examined. Inasmuch as the greatest amount of choline found was about 0·05 per cent., it cannot be considered dangerous; at the same time, it has been known to be injurious (Böhm, *loc. cit.*).

The amount of choline is higher in etiolated sprouts than in seeds; at the same time, there is a corresponding diminution in the amount of lecithin.

Only bases soluble in water or alcohol were investigated, and of these only a portion. The methods of separation are fully described. N. H. J. M.

Essence of Roots of Polygala from Java. By Pieter van Romburgh (*Rec. Trav. Chim.*, 1894, **13**, 421—424).—The roots of *Polygala variabilis*, *D. C. oleifera*, Haeckel, and *Javana* yield, on distillation with steam, small quantities of a heavy oil, sp. gr. = 1·174 at 27°, b. p. 222°, consisting almost entirely of methylic salicylate. The amount obtained, in each case, from 2 kilos. of roots was only about 1·5 c.c. JN. W.

Volatile Principles of Coca Leaves from Java. By PIETER VAN ROMBURGH (*Rec. Trav. Chim.*, 1894, **13**, 425—428).—On exposing some fresh coca leaves (*Erythroxylon coca*, Lamarck) to air charged with chloroform vapour, they behaved in the same way as tea leaves, darkening in colour, and acquiring a fragrant odour, and as the odour resembled that of the roots of *Polygala* (preceding abstract), the darkened leaves were distilled with steam, with the result that, as in the former case, it proved to be due to methylic salicylate. This, however, had not been formed or liberated by the action of the air or chloroform, as it can be isolated from the untreated leaves, and occurs, moreover, like the vegetable alkaloïds and other products of development, in greatest quantity (0·12 per cent.) in the youngest leaves. The product from 140 kilos. of leaves appeared to contain, in addition, salicylaldehyde and acetone. Other species of erythroxylon gave the same results. JN. W.

The Resin of German Pines. By HEINRICH MAYR (*Bied. Centr.*, 1895, **24**, 254—255; from *Bot. Centr.*, 1894, **59**, 52).—Of the various parts of the trees, the root-wood is richest in resin, next the stem to a height of 2 m., and the branches; the bark is the poorest in resin. The south half of the trunk is always richer than the north half, and the upper sides of roots and branches richer than the under sides. The amount of resin increases with the age of the trees, and is greater in warm positions and in trees growing in light soil. Only growing cell membrane is permeable to resin; fully developed cell walls, whether woody or not, do not allow the passage of resin as long as they are saturated with water. N. H. J. M.

Composition of Oat Plants. By ALBERT ATTERBERG (*Bied. Centr.*, 1895, **24**, 259—262; from *Årsberättelse f. Kalmar kem. stat. f. året.*, 1888–89; compare Abstr., 1888, 317).—By growing oats in nutritive solutions rich in phosphates, the percentage of nitrogen was reduced to 0·25 per cent. in the straw, and was 1·50 to 1·40 in the grains. When increasing amounts of nitrogen were given to the plants, the percentage of nitrogen remained fairly constant; but with still larger amounts of nitrogenous manure, an increase in the percentage of nitrogen of the produce was observed, especially when less phosphoric acid was applied.

European barley becomes gradually poorer in nitrogen, whilst in America the crops are still very rich in nitrogen; this is probably due to greater use of phosphates in Europe than in America. As a rule, the relation $N_2 : P_2O_5$, both in oat grain and in green oats, varies proportionally with the relation in the manure. When this relation is greater than 1·7 : 1·0, phosphatic manure is more necessary than nitrogenous. When the relation is less than 1·6 : 1·0 nitrogenous manure is wanted.

The percentage of potash varies only slightly in oat grain, but in the straw may vary from 0·3 to 5·0 per cent. In straw, potash may be replaced to a considerable extent by soda. Straw containing as little as 0·37 to 0·38 per cent. of potash is unhealthy; with insufficient soda present, the disease appears when the straw contains as much as 1·0 per cent. of potash.

In oats grown under natural conditions, the relation between nitrogen, phosphoric acid, and potash varies as follows:—100 : 21—67 : 21—173; when grown on peaty soil the relation is 100 : 33 : 62.
N. H. J. M.

Composition of different kinds of Berries. By ALBERT EINECKE (*Landw. Versuchs.-Stat.*, 1895, **46**, 21—22).—Analyses of six varieties of gooseberries and five varieties of currants were made, including amount of sap, sugar, free acid, extract, nitrogen, ash, and phosphoric acid in ash. To ascertain whether the differences in composition are due to the special characters of the varieties or to conditions of cultivation, weather, &c., the investigation will have to be continued for some years.
N. H. J. M.

Composition of Soils from South India. By CECIL MASSEY (*Chem. News*, 1895, **71**, 261—262).—Analysis of four arable soils, bearing coffee, from Coorg, South India, gave the following numbers per cent.

	I.	II.	III.	IV.
Moisture	6·68	6·22	7·02	7·42
Organic matter and combined water	3·70	4·30	3·97	4·84
Fe_2O_3	4·20	3·82	5·00	3·32
Al_2O_3	5·40	6·22	6·19	6·83
CaO	0·86	0·99	0·82	1·00
MgO	0·21	0·30	0·26	0·35
K_2O	0·62	0·73	0·58	0·68
Na_2O	0·38	0·34	0·30	0·41
P_2O_5	0·40	0·57	0·71	0·81
SO_3	0·12	0·21	0·19	0·20
CO_2	0·21	0·30	0·19	0·24
Cl	0·02	0·03	0·09	0·08
SiO_2 and insoluble	77·20	75·97	74·68	73·83
N per cent. in organic matter	0·69	0·83	0·79	0·86
Specific gravity	2·50	2·56	2·46	2·39

Bacteriological examination showed the following number of microbes per gram of each soil: I, 196,000; II, 253,000; III, 210,000; IV, 264,000.
D. A. L.

Effect of Sulphurous acid on Soil and on its Produce. By A. DAMSEAUX (*Bied. Centr.*, 1895, **24**, 279; from *Influence des dégagements d'anhyd. sulfureux sur les terres et sur la production*, Brussels, 1894).—The effect of sulphurous acid is to increase the percentage of ash constituents, especially in meadow and pasture grasses. Silica, iron, and aluminium increase, whilst phosphoric acid and potash decrease. As the amounts of proteïds and fat diminish, there is also a diminution in the digestibility of the proteïds. The plants produced illness in the animals which consumed them.

N. H. J. M.

Amount of Nitrogen in the Humus in Soils of Arid and Humid Regions. By EUGEN W. HILGARD and MEJER E. JAFFA (*Bied. Centr.*, 1895, **24**, 218—219; from *Agric. Science*, **8**, 165—171).—Soils from the humid regions of the Mississippi and from Louisiana yielded humus (by Grandeau's method) containing from 4 to 5 per cent. of nitrogen. In upland soils, the amount of humus was rarely as much as 0·5, and often less than 0·2 per cent. Nitrogenous manures on such soils were, however, frequently without effect, or even injurious, indicating that the humus of rich soils must be unusually rich in nitrogen. The following average percentage results are given. The numbers in brackets indicate the number of samples.

	Per cent. of humus in soil.	Nitrogen.	
		In humus.	In soil.
Upland (arid) soil. California (18)	0·75	15·87	0·101
Lowland (arid) soil. California (8)	0·99	10·03	0·102
Humid soil from arid and humid regions of California (5)	1·86	5·03	0·088
Humid soils—other States (5)	5·04	5·24	0·132

The differences between the amounts of nitrogen in the soils of arid districts and those of humid soils are very striking. In some cases the humus was richer in nitrogen than proteïds generally are. A strongly alkaline soil containing much sodium carbonate, and considerable quantities of sodium nitrate and phosphate, and potassium sulphate, yielded an inky black extract, from which humus containing 17 per cent. of nitrogen was obtained.

The humus of porous soils is, as a rule, poorer in nitrogen than that of dense soils; a high percentage of alkaline earthy carbonates is favourable to accumulation of nitrogen. N. H. J. M.

Utilisation of the Nitrogen of Farmyard Manure and of Green Manure. By JULIUS KÜHN (*Bied. Centr.*, 1895, **24**, 222—223; from *Deut. Landw. Presse*, 1894, No. 15, 22, 33, 34, 48—51).—The author maintains, in opposition to Wagner, that the nitrogen of farmyard manure is more used up than that of green manure. According to the kind of food, 56 to 80 per cent. of the nitrogen of dung should be available to plants in the first year. Wagner's experiments were not suited to decide the question, as unequal amounts of nitrogen were applied to the different plots, and the farmyard manuring was excessive. N. H. J. M.

Analytical Chemistry.

Apparatus for Rapid Calibration of Measuring Vessels. By J. C. Boot (*Rec. Trav. Chim.*, 1894, **13**, 417—425).—A column of 10 bulbs, each containing accurately 10 c.c. from mark to mark on the tubes connecting them, is connected at the base, through a three-way tap, with the base of a 10 c.c. burette, graduated in 1/50 c.c. The apparatus is filled through a second tap at the base of the bulb burette, and either branch can be discharged through the third-way of the three-way tap. The vessel to be calibrated is filled from the bulb burette, and the excess or defect from the reputed volume measured by means of the fine burette. In calibrating a 50 c.c. flask, for example, the bulb burette is filled to the 50 c.c. mark, the fine burette to the 10 c.c. mark, and the flask is filled from the former. If its capacity is less than that reputed, the liquid in the bulb burette will remain above the zero mark, and the difference is measured by refilling the lowermost bulb through the three-way tap from the fine burette, and noting the amount remaining in the latter. If, on the other hand, the capacity is greater than the reputed capacity, the flask will not be quite filled by the contents of the bulb burette, and the excess is measured by direct addition from the fine burette.

Sulphuric acid of sp. gr. 1·2 is recommended as the calibrating liquid, as it does not adhere to the glass, and is neither hygroscopic nor liable to evaporation. Jn. W.

Standardising Acid Solutions. By Edgar P. Perman and W. John (*Chem. News*, 1895, **71**, 296).—It is suggested that borax should be used for standardising sulphuric or hydrochloric acid, methyl-orange being used as indicator [compare Salzer (Abstr., 1894, ii, 27) and Rimbach (Abstr., 1893, ii, 233)]. D. A. L.

Carius-Volhard Estimation of Halogens. By James Walker and James Henderson (*Chem. News*, 1895, **71**, 295—296).—F. W. Küster, finding that silver nitrate acts on the glass if used in excess in the Carius method, takes exception to the method described by the authors (this vol., ii, 326); but they point out that such action does not take place to a serious extent below 280°, and as the reaction can be completed at 250—260° (by using 2 c.c. of nitric acid, sp. gr. 1·5, instead of the smaller quantity used by Küster), volumetric results, agreeing well with the gravimetric numbers, are obtained, as exemplified by the numbers for the halogens in paradichloro- and paradibromo-benzene given in the paper. D. A. L.

Estimation of Sulphurous and Sulphuric acids in the Products of Combustion of Coal-gas. By Uno Collan (*Zeit. anal. Chem.*, 1895, **34**, 148—158).—From the results of experiments by Young and others, it has hitherto been considered that the sulphur in coal-gas is mainly oxidised to sulphuric acid during the combustion.

The author shows experimentally that Young's method of absorbing the products of combustion by an alkali is misleading, inasmuch as sulphurous acid mixed with air is oxidised to sulphuric acid under these conditions. But when the products of combustion (from a non-luminous Bunsen flame) are allowed to act directly on chromic acid, a quantity of the chromic acid is reduced, which corresponds with the presence of 89—99 per cent. of the sulphur in the form of sulphurous acid. Since no other cause for the reduction of the chromic acid could be detected, the author concludes that the chief product of the combustion of the sulphur is not sulphuric, but sulphurous, acid.

M. J. S.

Detection and Estimation of Selenium in Meteoric Iron. By Henry N. Warren (*Chem. News*, 1895, **71**, 249—250).—Ten grams of filings of the iron is mixed with sufficient flowers of sulphur and heated to redness in a combustion tube in a current of oxygen; the sulphurous and selenious anhydrides produced pass into a series of bulb-tubes containing water in which the selenium collects. This is heated while in the liquid to 27°, and the selenium is then dried in an air-bath in a platinum dish. In six specimens of meteoric iron examined the following quantities of selenium have been found:— 0·23, 0·05, 0·04, 0·06, 0·08, and 0·05 per cent.

D. A. L.

Apparatus for Measuring out Small Drops of Mercury for Kjeldahl's Process. By Paul Liechti (*Zeit. anal. Chem.*, 1895, **34**, 169—170).—This is, externally, exactly like a stopcock separator, but the plug of the stopcock, instead of being pierced, has at one side a conical cavity of such size as to contain the required quantity of mercury. This fills when placed upwards, and delivers its charge when the plug is turned through 180°.

M. J. S.

Estimation of Nitric Nitrogen in Presence of Organic Nitrogen. By Theodor Pfeiffer and H. Thurmann (*Landw. Versuchs-Stat.*, 1895, **46**, 1—20).—Of the methods generally employed, reduction with zinc dust in alkaline solution gave unsatisfactory results with urine, whilst Schloesing's method is liable to give rise to loss of nitrogen in presence of organic matter owing to the action of nitric oxide on ammonia or on urea.

The following method was found to yield good results. The liquid contained in a Linter pressure flask is treated with about 10 grams of caustic soda, and heated at 120—130° for about eight hours. When cold, the contents of the flask are poured into a distilling flask, the solid matter washed on to a filter and dried. The liquid is treated with a further quantity of caustic soda and boiled until no more ammonia is evolved. The dried precipitate is then put into the flask, washing the paper with acetic acid and water to remove the last traces, and the whole reduced with zinc-iron in the usual manner. The distillation must be carefully done owing to frothing. It seems impossible to obtain caustic soda free from nitrates, but if the same quantity is always employed, a correction can be made. For many substances, boiling with alkali is sufficient.

Ammonia may be generally estimated in farmyard manure, &c., by distilling with magnesia. Commercial urea when distilled with magnesia yields ammonia, but this is shown to be due to ammonium carbonate present as an impurity. Urea which has been precipitated with nitric acid gives no ammonia.

The following method is given for preparing fæces for analysis. The fæcal matter is emptied into sifted peat meal (15 to 20 per cent.), quickly mixed and dried after addition of acid. An odourless, friable mass is obtained, from which good samples are readily taken. The exact amount of peat and its composition must, of course, be known.

N. H. J. M.

Practical Working of Pelouze's Process. By VINCENT EDWARDS (*Chem. News*, 1895, **71**, 307).—Ten grams of the nitrated manure is dissolved, filtered, and made up to 200 c.c.; 20 c.c. of this solution and 50 c.c. of a solution containing 100 grams of ferrous sulphate and 100 c.c. of strong sulphuric acid per litre, are run into a 600 c.c. flask, fitted with a rubber stopper and a Bunsen valve, and boiled until the liquid becomes viscid. The flask is enveloped in a cloth as a precaution in case of fracture, and, when cool, 100 c.c. of water is added, and even if all the material in the flask is not very soluble, the solution is titrated with a solution containing 14·742 grams of potassium dichromate per litre, until a bright yellow colour is obtained with a drop of ferricyanide.

D. A. L.

Preparation of Thioacetic acid, and its Application in Chemico-legal Investigations. By ROBERT SCHIFF (*Ber.*, 1895, **28**, 1204—1206; compare this vol., ii, 84).—In preparing thioacetic acid by acting on glacial acetic acid with phosphorus pentasulphide, addition of crushed glass is found to prevent the frothing which usually takes place in the distilling flask. Rectified, thioacetic acid is free from arsenic, and this metal may be determined quantitatively by its means; the necessity of providing a continuous stream of hydrogen sulphide free from arsenic is therefore obviated, as the quantitative decomposition of arsenious and arsenic acids is effected by boiling the solution in hydrochloric acid for a few minutes with thioacetic acid.

M. O. F.

Analysis of Organic Compounds containing Boron and Fluorine. By V. GASSELIN (*Ann. Chim. Phys.*, 1894, [7], **3**, 69—78). —See this vol., i, 453.

The Inclusion of Barium Chloride by Barium Sulphate. By THEODORE W. RICHARDS and HARRY G. PARKER (*Zeit. anorg. Chem.*, 1895, **8**, 413—423).—The authors have determined the amounts of barium chloride included in the precipitate when sulphuric acid is estimated as barium sulphate. The sulphuric acid solution contained 3·214 per cent. of sulphuric acid as determined by titration with pure sodium carbonate. It was estimated by precipitation with barium chloride, taking all known precautions to prevent the inclusion of barium chloride in the precipitate. The precipitate was separated, and the filtrate evaporated to a small bulk in order to obtain the dissolved barium sulphate. The whole precipitate was then fused with pure sodium carbonate, and the chlorine in the aqueous solution of the melt determined as silver chloride. The chlorine is then calculated into barium chloride, and the weight of the latter subtracted from that of the barium sulphate. The results of two tests, without the correction, for included barium chloride gave 3·218 per cent. H_2SO_4; when corrected for barium chloride they gave 3·214 per cent. H_2SO_4. The mean result of 17 experiments, in which the precipitation of the barium sulphate was performed with the ordinary precautions, was 3·215 per cent. H_2SO_4 without correction, and 3·200 per cent. when corrected for included barium chloride, which shows that the solubility of the barium sulphate nearly eliminates the error due to the inclusion of barium chloride. An excess of barium chloride does not increase the error due to inclusion. This error is, however, greatly increased by adding the sulphuric acid to the barium chloride instead of *vice versâ*, and, also, it is enormously increased by the presence of a large quantity of hydrochloric acid. The error is diminished by dilution of the solutions, and also by stirring, whilst the barium chloride is being added. E. C. R.

Volumetric Estimation of Zinc. By LÉONCE BARTHE (*Bull. Soc. Chim.*, 1895, [3], **13**, 82—85).—Fresh tincture of hollyhock is not affected by the common inorganic salts of zinc, but is turned green by alkali; excess of acid in solutions of zinc can, therefore, be directly titrated. On the other hand, zinc solutions become neutral to phenolphthaleïn only when enough alkali has been added to form a basic salt, $ZnSO_4,4ZnO$. By combining these two processes, zinc can be titrated in solutions of its nitrate and sulphate.

The salt (1/1000 equivalent) is dissolved in water or dilute acid (to 100 c.c.), and an aliquot portion (10 c.c.) diluted (to 100 c.c.), and titrated for free acid; a second portion is titrated with alkali in presence of phenolphthaleïn. The percentage of zinc is equal to the difference between the two titres in c.c. of decinormal alkali multiplied by the factor 0·00325 × 1·25. JN. W.

Separation of Copper and Cadmium. By ALLERTON S. CUSHMAN (*Amer. Chem. J.*, 1895, **17**, 379—383).—Cadmium sulphide dissolves readily in a saturated solution of the alkali chlorides in the presence of dilute hydrochloric acid. The reaction probably takes place according to the equation $CdS + 2RCl + 2HCl = CdCl_2,2RCl + H_2S$. Copper sulphide is not attacked at all under these conditions, and the reaction thus serves as a very delicate means of detecting minute traces of cadmium in the presence of copper. The test is best carried out as follows. About 2 c.c. of the solution containing the two metals is made slightly acid with hydrochloric acid, and about 20 c.c. of a saturated solution of sodium chloride added. Hydrogen sulphide is passed until the copper is entirely precipitated, and the precipitate then filtered off through a dry filter, and the filtrate run into a dry test tube. On dilution of the filtrate, the cadmium sulphide is precipitated. It is best to allow a few drops of water to run down the side of the test tube, when a yellow line of cadmium sulphide is formed at the junction of the two liquids. If the amount of cadmium present is very small, it is best to use very dilute ammonia instead of water, as the yellow line is developed more quickly. If the separation of the other metals (lead, bismuth, &c.) is incomplete, however, they somewhat mask the reaction, especially if ammonia is employed. 0·1 milligram of cadmium can be at once detected by this method, whilst with 0·01 milligram a yellow ring develops in half an hour. The reaction is much more delicate than either the cyanide or sulphuric acid methods for separating copper and cadmium.

L. T. T.

Estimation of Antimony as Tetroxide. By Otto Brunck (*Zeit. anal. Chem.*, 1895, **34**, 171—174).—This method has latterly fallen into discredit, in consequence of the statement by Bunsen that the tetroxide is reduced to trioxide and volatilised at a temperature only a little higher than that at which it is formed. This, however, is shown to be incorrect, provided that reducing gases from the flame are completely excluded. In an uncovered crucible neither reduction nor loss of weight takes place; but with the lid on reduction occurs even when the flame surrounds only the lower half of the crucible. By supporting the crucible in a closely-fitting ring of asbestos board, access of reducing gases is prevented, and a cover can be employed. From weighed quantities of antimony, whether in the form of metal, or as sulphide, the amount of oxide obtained agreed exactly with the formula Sb_2O_4, and with access of air a constant weight was rapidly attained. The method is, therefore, thoroughly trustworthy.

M. J. S.

Estimation of Thiophen in Benzene. By Georges Denigès (*Compt. rend.*, 1895, **120**, 781—783).—In order to estimate thiophen in the form of the compound, $2HgSO_4,2HgO,C_4SH_4$ (this vol., i, 411), 20 c.c. of the reagent (containing mercuric oxide, 50 parts; sulphuric acid, 200 parts; water, 1000 parts) is mixed with 2 c.c. of the benzene in a flask of 60 c.c. capacity, the stopper is tightly tied down, and the flask heated on a water bath for about 15 minutes, with occasional vigorous agitation. The precipitate is washed with boiling water, and dried at 110—115°; its weight multiplied by 0·0758 gives the weight of thiophen. The results are satisfactory, although always very slightly too low.

If the reagent (1 part) is mixed with methylic alcohol (3 parts) free from acetone, the reaction will take place at the ordinary temperature, since the alcohol dissolves the benzene; 10 c.c. of the mixture is agitated with 1 c.c. of the benzene, and 1 part of thiophen in 100,000 can be detected.

In aqueous solutions the composition of the precipitate remains constant, whatever the proportions of thiophen and mercuric salt, but in presence of methylic alcohol this is no longer the case, and a definite compound is obtained only when the mercury is in excess with respect to the thiophen, and the precipitate then has the composition, $HgSO_4,2HgO,C_4SH_4$.

To make an estimation at the ordinary temperature, 2 c.c. of benzene is dissolved in 30 c.c. of methylic alcohol, and 10 c.c. of the mercury solution is added rapidly, and the mixture agitated; after about 20 minutes the precipitate is washed with boiling water and dried. Its weight, multiplied by 0·1034, gives the weight of thiophen. The results quoted are very satisfactory. C. H. B.

Preservative Value of Formaldehyde and its Detection in Milk. By ROBERT T. THOMSON (*Chem. News*, 1895, **71**, 247—248).—In comparative experiments the author has found that as a preservative for milk, 8¾ grains per gallon of formaldehyde is as effective as 35 grains of salicylic acid, or 35 grains of boric acid, half as free acid, half as borax, and that it surpassed 35 grains of free boric acid, or 17½ grains of benzoic acid.

To detect formaldehyde in milk, 20 c.c. is carefully distilled from 100 c.c. of milk, and placed in a stoppered tube with 5 drops of a solution, prepared by dissolving 1 gram of silver nitrate in 30 c.c. of water, adding just sufficient dilute ammonia to redissolve the precipitate first formed, and making up to 50 c.c. with water. The tube is set aside in the dark, and the presence of formaldehyde is indicated by the formation of a black (not brown) deposit, which may take 12 to 18 hours to form, if only a small quantity of formaldehyde is present; as little as 2 grains per gallon may be detected in this manner.

D. A. L.

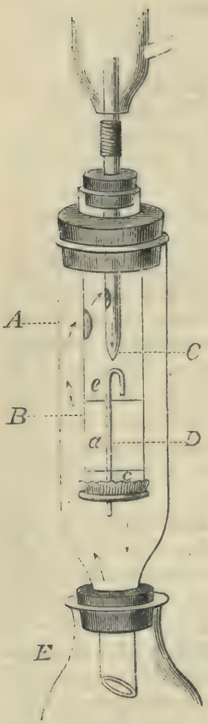
Precipitation of Uric acid and Xanthine Derivatives. By MARTIN KRÜGER (*Chem. Centr.*, 1894, ii, 483; from *Du Bois-Reymond's Archiv.*, 1894, 374—378).—Uric acid, hypoxanthine and adenine (compare Abstr., 1894, ii, 74) can be completely precipitated as cuprous compounds—of the formula $C_5H_3Cu_2N_5$ in the case of adenine—by adding copper sulphate and sodium hydrogen sulphite; the precipitates dissolve respectively in 560,000, 250,000, and 200,000 parts of water. If an attempt is made to estimate uric acid in urine by means of this reaction, 20·6 per cent. more nitrogen is found than by the Ludwig-Salkowski method. This excess of nitrogen is due to the precipitation of xanthine and sarcine bases with the uric acid, and the amount of the excess is a measure of the quantity of these bases present. As a mean of 11 experiments with normal urine, the ratio of nitrogen present as bases to that present as uric acid, as determined by the Ludwig-Salkowski method, was found to be 3·82 : 1.

In the estimation of the total nitrogen of both bases and uric acid, 100 c.c. of urine is heated to boiling, 10 c.c. of commercial saturated sodium hydrogen sulphite solution, and 10 c.c. of a 13 per cent. copper sulphate solution are added, the whole is then heated to boiling again, treated with 5 c.c. of 10 per cent. barium chloride solution, and set aside. After two hours, the liquid is filtered through a folded filter, the precipitate washed five times with hot water, and the nitrogen in it determined by the Kjehdahl method. C. F. B.

A New Method of estimating Fat in Milk. By A. N. NAHM (*Chem. Centr.*, 1894, ii, 669—670; from *Milch. Zeit.*, **23**, 555—558).—One hundred c.c. of milk is heated to boiling for 25 minutes in a special apparatus, after adding 25 c.c. of a mixture containing 4·5 per cent. potassium hydroxide, 56 per cent. of amylic alcohol, 15·5 per cent. of ethylic alcohol, and 30 per cent. of ammonia. The mixture should be well shaken every five minutes.

A pinch cock being opened, the liquid is now forced by means of an india-rubber valve into a calibrated tube 20 cm. in length, each division of which represents 0·05 per cent. of fat. After standing some time in a water bath, the volume of the fatty layer is read off.

L. DE K.



Modification of Tollens' Fat-extraction Apparatus. By UGO MILONE (*Chem. Centr.*, 1894, ii, 642; from *Boll. Soc. Nat. Napoli*, [2], **8**, 1—3).—The tube *A* is 25 by 5 cm., *B* is 17 by 3 cm.; the flask, *E*, which contains the boiling ether, has a capacity of 60 c.c. *B* is closed at the lower end by a piece of cloth tied over it; on this is placed a little cotton-wool, freed from fat, then the substance to be extracted, and, above all, a little more cotton-wool. The ether extract drops through the cloth, but in case it should accumulate in *B*, the siphon *D* is added, passing through the cloth; this draws off the ether extract when it has reached the level *e*.

C. F. B.

Butter. By CARL T. MÖRNER (*Zeit. anal. Chem.*, 1895, **34**, 175).—The author has determined the "baryta number" of numerous specimens of fresh butter from southern and mid Sweden, according to the process of König and Hart (Abstr., 1891, 1301), and finds it to vary from 180 to 228, the average being 200·7, which is a little lower than that (221) found by König and Hart.

M. J. S.

Iodine Absorption. By HERMANN BREMER (*Chem. Centr.*, 1894, ii, 496; from *Forschungsber. Lebensm.*, **1**, 318—325).—The author thinks the Hübl method a very exact one. When dealing with drying oils, the iodine solution should be allowed to act for 18 hours, and the test performed according to Dieterich's directions. With other oils, two hours are sufficient at a temperature of 15—18°. An excess of 10 per cent. of iodine is sufficient for ordinary oils, 30 per cent. for drying oils. Too large an excess of iodine, or a temperature below 15° or over 30°, affects the accuracy of the results. Contrary to Gantter's statement, stearic acid does not absorb iodine.

L. DE K.

Pumpkin Oil. By ARTHUR SCHATTENFROH (*Chem. Centr.*, 1894, ii, 518; from *Zeit. Nahrungsm. Hyg. Waar.*, **8**, 202—205).—The oil is pressed from pumpkin seeds, after they have been heated several times. It is insoluble in water and alcohol, soluble in ether, chloroform, benzene, carbon bisulphide, light petroleum, and acetone; its sp. gr. = 0·9226 (0·9234) at 30°; it solidifies at −16°, and the fatty acids obtained from it melt at 25—27°, and solidify at 23—24°; it is optically inactive. It contains 1·52 per cent. of unhydrolysable matter, 8 of glycerol, 80·9 of volatile, and 15·3 of solid insoluble acids; it contains no nitrogen, sulphur, chlorine, or lecithin; it has an acid number of 1·27, a saponification number of 188·7, and an ether number of 187·3. It contains phytostearin; its Reichert-Meissl number is 9·24, its Hehner's number 96·2, its acetyl number 27·2, and its Hübl's iodine number 113·4. C. F. B.

New Test for Morphine. By LAMAL (*Chem. Centr.*, 1894, ii, 602; from *Semaine Médic.*, **14**, 267).—Solutions of morphine give, on addition of uranium acetate, a reddish-brown colour, which disappears on adding acids, whilst, on adding caustic alkalis, a deep red precipitate is formed, which turns yellow on adding an excess of the reagent. The test is best made by putting 2—10 drops of the morphine solution into a porcelain dish and adding the same quantity of uranium solution (0·015 gram of uranium acetate and 0·01 gram of sodium acetate in 5 c.c. of water). After evaporating on the water bath, concentric, bright, or hyacinth-red spots are left. The reaction is still visible with 0·05 milligram of the alkaloïd. Oxymorphine gives the same reaction, but toxines and most of the other alkaloïds do not. Salicylic acid gives brick-red spots, tannin, gallic acid, and pyrogallol brown ones. Phenol gives a brown colour, slowly disappearing on warming. The coloration with uranium acetate is very permanent, and may serve as evidence in court. L. DE K.

Fallacies of Post-mortem Tests for Morphine. By DAVID L. DAVOLL, jun. (*J. Amer. Chem. Soc.*, 1894, **16**, 799—808).—The author's experiments were made on the body of a dog which, after being shot, was buried for 45 days in a tight pine box, with cover screwed on, under five feet of gravelly soil. The various organs were then tested as if poisoning by morphine had been suspected. Portions of the various extracts were also examined after a trace of morphine had been purposely added.

The experiments proved, that when dealing with cadaveric bodies the only trustworthy tests are:—Fröhde's reagent (sulpho-molybdic acid), Le Fort's test (iodic acid), and ferric chloride solution.

L. DE K.

Estimation of Gelatin and Albumin in Presence of Peptone. By ERNST O. BECKMANN (*Chem. Centr.*, 1894, ii, 898; from *Forschungsber. Lebensm.*, **1**, 423—425).—Formaldehyde precipitates gelatin from concentrated solutions as formalingelatin. Dilute solutions evaporated with the reagent also leave the insoluble compound generally mixed with trioxymethylene, which may be extracted with boiling water. Much free acid interferes with the complete precipitation. Peptones (glutenpeptone, meat-peptone) remain soluble; egg-albumin and serum-albumin become insoluble. The author has founded on these tests a quantitative method for separating gelatin from peptones and albumins. The albumin is first precipitated in an aliquot part of the solution by precipitating with acids, and in another part both gelatin and albumin are precipitated by means of formaldehyde. The difference gives the gelatin. The process may render good services when testing milk or meat products. L. DE K.

Application of Dyes to the Recognition and Distinction of Diverse Proteïds. By Bogmolow (*Chem. Centr.*, 1894, ii, 855; from *St. Petersb. med. Woch.*, 1894, No. 34).—The following colour reactions are given:—Albumin with corallin, blue-rose. Myosin with methylene-blue and gentian-violet, a blue shade; with methylene-green, a decidedly dark green; with eosin and floxin, a raspberry-red. Peptone with congo, orange-red precipitate; with eosin, methyl-green and safranine, a change of shade without dichroism; with corallin powder, orange-yellow, but no colour with the solution; with floxin, raspberry-coloured flocks. Nucleoalbumin with eosin, orange; with methyl-green, pure green; with gentian-violet, blue. Syntonin with congo, brown; with safranine, yellow; with corallin, reddish-yellow; with methyl-green, green. Alkali albuminate with eosin, rose-violet; with corallin, cherry-violet; with safranine, no change; with congo, a red shade; with floxin, no change. Fibrin becomes coloured by all colouring matters, most feebly with acid magenta. Mucin can, according to Zenoni, be recognised in sputum by mixing the sample on a clock-glass with alcohol and adding safranine, whereon mucin becomes yellow, but albumin (in sputum from pneumonic patients) red. Oxyhæmoglobin crystals from a dog or horse are decolorised by solutions of dye-stuffs in part without change of form, but in part with distortion at the ends, so that they assume a form resembling that of hæmatoidin crystals. Methhæmoglobin and hæmoglobin, on the other hand, are coloured by a whole series of colouring matters. Oxyhæmoglobin, crushed under the cover-glass, is dyed red by rubin, hæmoglobin becoming violet. A. G. B.

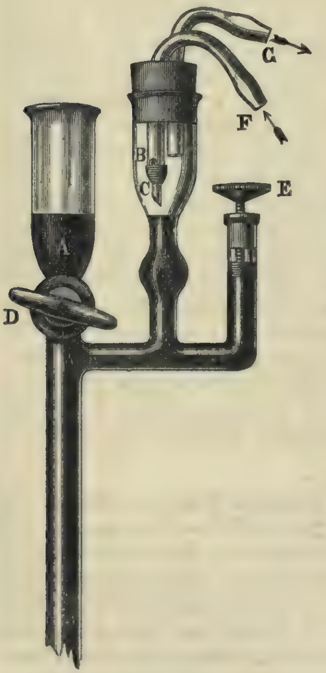
Medico-Legal Detection of Blood Stains. By Friedrich Gantter (*Zeit. anal. Chem.*, 1895, **34**, 159—160).—It is often of importance to be able to prove that the stains on rusty iron are not due to blood, and this, in consequence of the difficulty of obtaining the usual blood reactions under these conditions, has not hitherto been possible. A highly sensitive reaction is, however, obtained as follows. A small fragment of the rust, placed on a microscope slide on a black ground, is treated with a drop of feebly alkaline water. Any air bubbles which escape, disappear almost instantly, especially on rubbing with a glass rod. On now adding a drop of hydrogen peroxide, numerous bubbles of oxygen are speedily produced, and collect in the form of a delicate froth, surrounded by a ring of clear liquid, the froth remaining permanent for several hours. Stains six months' old give this result as sharply as fresh ones. The non-production of this effect may be regarded as a certain proof of the absence of blood, but the reaction is unfortunately not characteristic for blood, since it is equally produced by pus and other animal products. It affords, however, an admirable means of confirming the presence of hæmin crystals, when, as sometimes happens, the mere microscopic appearance is not sufficiently certain. M. J. S.

General and Physical Chemistry.

The Constancy of the Calomel Electrode. By GEORGE W COGGESHALL (*Zeit. physikal. Chem.*, 1895, **17**, 62—86).—The author prepared a number of calomel electrodes, in order to test their values and constancy at different times. The first set of experiments gave, from time to time, undoubted deviations from a constant value, and the form was slightly altered by placing over the mercury a quantity of sand grains, by which the surface of the calomel was increased and the saturation of the solution more completely ensured. With these cells it was found that the electromotive force during 40 days did not deviate from the normal value by more than 0·0008 volt. Experiments were next performed to test whether the size of the mercury surface affected the constancy of the electrode, the results being in the negative. The time required for the E.M.F. to reach its constant value was in most cases from 30 hours to two days. The effect of slight impurities was found by the use of commercial calomel and mercury, and although the purity of the mercury is of considerable importance, the commercial calomel is only very slightly inferior to the pure compound. It is hence possible to obtain a number of electrodes giving similar results, and the constancy of ordinary calomel electrodes may be regarded as within about 0·001—0·002 volt. The temperature influence was also determined, and the E.M.F. found to increase with the temperature; the coefficient between 0° and 25° being 0·000678 and between 25° and 50°, 0·000647 (volt per degree), whilst the E.M.F. reaches its value in a few hours after the increase of temperature. The absolute value found by Rothmund was 0·561, a number the author considers as probably correct (this vol., ii, 35). L. M. J.

Electrical Conductivity near the Critical Temperature. By ADOLFO BARTOLI (*Gazzetta*, 1895, **25**, i, 205—207).—The author has repeated and confirmed his early observations on the electrical conductivity of liquids and gases near the critical temperature, using slightly modified apparatus. Pure benzene has no conductivity either in the liquid or gaseous state, that is, just below and just above the critical temperature. Methylic alcohol and sulphurous anhydride, however, conduct slightly when liquid just below the critical temperature, but lose this feeble conductivity when gaseous just above that temperature. W. J. P.

Specific Heat of Hydrogen Peroxide. By WALTER SPRING (*Zeit. anorg. Chem.*, 1895, **9**, 205—211).—The author has determined the specific heat of solutions of hydrogen peroxide of different strengths, at temperatures from 50—20°, employing the radiation method. A solution containing 71·54 per cent. of hydrogen peroxide has the lowest specific heat, namely, 0·7615. A solution containing 74·54 per cent. gave the specific heat 0·7845, and when the specific heat of hydrogen peroxide is calculated by taking into account the specific heat of the water present, the number 0·6893 is obtained, and this number varies to a less degree with the temperature than is the case with solutions containing less hydrogen peroxide. Probably a decomposition takes place, and the value obtained represents the specific heat plus the heat formed by the reaction $H_2O_2 = H_2O + O$. The smallest value, 0·6208, is obtained with a solution containing 34·25 per cent. of hydrogen peroxide; but this again increases to 0·8065 for a solution containing 30·59 per cent. of hydrogen peroxide; whence the author concludes that, with regard to the specific heat, solutions of hydrogen peroxide behave like an aqueous solution of alcohol, for which the specific heat is greater than the sum of the specific heats of its constituents. E. C. R.



Thermostat. By BERLEMONT (*Bull. Soc. Chim.*, 1895, [3], **13**, 228—229).—The lower part, not shown in the figure, is immersed in the oven, &c. The mercury, on expanding, rises in the middle tube, and cuts off the main supply of gas, enough only to keep the burner alight being allowed to pass through an aperture B, the size of which is regulated by an india-rubber ring C. In setting the apparatus, the mercury is allowed to flow from the middle tube back into the funnel A, until the gas is cut off within 10—15° of the desired temperature, and the adjustment is then completed by means of a screwed piston E. The maximum variation at high temperatures is stated to be 3°. Another form is made to work to 0·2° at temperatures about 35°. JN. W.

Solidification of some Carbon Compounds. By LOUIS BRUNER (*Compt. rend.*, 1895, **120**, 914—915).—Bromal hydrate when it solidifies, does not at once liberate the whole of its latent heat of fusion, but the action of aqueous potash develops from 2 to 4 Cals. more one hour after solidification than it does some days after solidification. The substance returns gradually to its original condition, and the latent heat of fusion is only slowly liberated, as observed by Berthelot in the case of chloral hydrate.

Thymol and menthol, on the other hand, although pasty after solidification, retain none of their latent heat of fusion.

C. H. B.

Melting Point of Difficultly Fusible Organic Compounds. By ARTHUR MICHAEL (*Ber.*, 1895, **28**, 1629—1633).—The melting point of many organic substances cannot be determined in the usual way, either because the substance sublimes before melting, or because it decomposes before the melting point is reached; the latter case being particularly frequent with substances of high melting point. If, however, the substance is brought into a bath already heated very nearly to its melting point, and the temperature of the bath is then rapidly raised, a melting point can often be found. For this purpose, it is best to enclose the substance in a tube sealed at both ends; this tube is best made of hard glass in the case of a substance of very high melting point, and should be not less than 1 mm. in diameter, so as to avoid the influence of capillarity. It is fastened by a spirally wound platinum wire to a glass rod, and is pushed down into the bath, when the latter has reached a suitable temperature. For temperatures up to 300° a bath of sulphuric acid was used; for those between 300—400° a bath of paraffin, of which about one-third has first been distilled off; the boiling point of the residue falls with use, however. For temperatures of 400—450° an air bath, kept rapidly stirred, was used, and heated in a bath of fusible metal; the substance was brought just below the level of the latter, and lighted by a reflected ray of sunlight.

In one or other of the above ways, the following melting points were determined. They varied somewhat with the time and manner of heating, and the experiment had often to be repeated several times in order to get an accurate estimation. Fumaric acid, 287—288°. Dibromosuccinic acid, 260—261°. Mellitic acid, 286—288°. Chloranilic acid, 283—284°. Asparagine, 234—235°. Aspartic acid, 270—280° (not quite all melted). Theobromine, 329—330°. Oxamide, 417—419°. Indigo blue, 390—392°. C. F. B.

The Determination of Boiling Points by the Dynamical Method. By GEORG W. A. KAHLBAUM (*Ber.*, 1895, **28**, 1675—1681).—In a recent abstract (*Ann. Phys. Chem.*, *Beibl*, 1895, **19**, 321), C. G. Schmidt states that the boiling points of liquids determined by the author by the dynamical method in many cases do not represent the normal boiling point but the boiling point of the superheated liquid. In the present paper, the author adduces a large number of new figures to prove that Schmidt's statement is incorrect, and that the numbers previously given are in reality the normal boiling points.

H. G. C.

Critical Temperature of Hydrogen. By LADISLAUS NATANSON (*Zeit. physikal. Chem.*, 1895, **17**, 43—48, and *Phil. Mag.*, **40**, 272—282).—From the equation $pv/p_cv_c = \mathrm{K}t/t_c$ (where p_c, v_c, and t_c are the critical values of the pressure, volume, and temperature) is deducible, the relation $t_c = \mathrm{AM}p_cv_c$, where M is the molecular weight and A a constant for all gases. The value of this constant for carbonic anhydride is $5{\cdot}4344 \times 10^{-7}$ in absolute units, the values for other gases giving satisfactory agreement. Using this value, the author calculates the critical densities of oxygen, argon, carbonic oxide, nitrous oxide, methane, ethane, and propane, the last three giving the numbers 0·202, 0·216, and 0·230 respectively. For hydrogen, use is made of Van der Waal's equation, and the deducible relatives $v_c = 3b$; $t_c/p_c = 8b/\mathrm{R}$, from which if the value $b = 0{\cdot}00070$ is taken, the critical volume of hydrogen is obtained as 23·45 (cc/gm), and if Olzewski's value of

20 atmospheres is accepted as the critical pressure, the critical temperature is obtained as −232°. The critical temperature is also calculated from Olzewski's observation that when hydrogen at 80 atmospheres pressure and −211° is allowed to stream out the appearance of boiling results. Assuming the expansion to be adiabutic, the equation $(p_c/p)^{k-1} = t_c/t_0$ leads, if p_c be taken at 20 atmospheres, to the value $t_c = 41{\cdot}7$, *i.e.*, −231·3°. L. M. J.

Transition Temperatures of some Racemates. By Jacobus H. van't Hoff, Heinrich Goldschmidt, and W. P. Jorissen (*Zeit. physikal. Chem.*, 1895, **17**, 49—61).—The transition temperature for the change of a mixture of + and − sodium ammonium tartrates into the double salt of Scacchi has been found to be 27°. The authors further determine the temperature of transition from the double salt to the mixture of sodium and ammonium racemates,

$$2(NaNH_4C_4H_4O_6,H_2O)_2 = (Na_2C_4H_4O_6)_2 + [(NH_4)_2C_4H_4O_6]_2 + 4H_2O.$$

The first determinations were made by the dilatometric method, but an accurate result could not be obtained by this means, the transition temperature appearing to be between 35·5° and 37·2°. Determinations were next made by a tensimetric method, the salts being contained in side bulbs of a closed evacuated U-tube, the limbs of which contained oil, and were brought close together. The temperature of this second transition was thus obtained as 34·45°, and that of the first change and formation of Scacchi's salt was found to be 26·6°. Solubility experiments are also recorded, and the diagrams of the equilibria fields of the several constituents added, while the third transition, that from the mixed + and − tartrates to the two racemates, is also determined, and found to be 29·5°. L. M. J.

Heat of Combination of Mercury with other Elements. By Raoul Varet (*Compt. rend.*, 1895, **120**, 921—923).—The action of potassium iodide solution and of potassium iodide and iodine solution on mercurous chloride, iodide, sulphate, and acetate, together with the author's previous researches, lead to the following results.

Hg liq. + Cl_2 = $HgCl_2$ sol.		develops	+53·3 Cals.
Hg liq. + Br_2 liq. = $HgBr_2$ sol.		,,	+40·6 ,,
Hg liq. + I_2 sol. = HgI_2 sol.	red	,,	+25·2 ,,
	yellow	,,	+22·2 ,,
Hg liq. + O gas = HgO sol.		,,	+21·5 ,,

C. H. B.

Heats of Formation of Mercurous Sulphate, Nitrate, and Acetate. By Raoul Varet (*Compt. rend.*, 1895, **120**, 997—1000).—The author has determined the heat of formation of mercurous acetate, nitrate, and sulphate, by the action of potassium iodide solution alone, and potassium iodide solution containing iodine. The acetate and sulphate are anhydrous; the nitrate crystallises with 2 mols. H_2O, and its heat of dissolution in dilute nitric acid, about 12°, is −12·4 Cals. The results are as follows.

Hg_2 liq. + S sol. + O_4 gas = Hg_2SO_4 sol.	develops	+175·0 Cals.
Hg_2 liq. + N_2 gas + O_6 gas + H_2O liq. = $Hg_2(NO_3)_2,2H_2O$ sol.	,,	+69·4 ,,
Hg_2 liq. + C_4 (diamond) + H_6 gas + O_4 gas = $Hg_2(C_2H_3O_2)$ sol.	,,	+202·1 ,,

C. H. B.

Heats of Formation of Mercurous Chloride, Bromide, Iodide, and Oxide. By Raoul Varet (*Compt. rend.*, 1895, **120**, 1054—1057).—The methods employed were in general the same as in the case of the acetate, nitrate, and sulphate (preceding abstract). The heat of formation of the oxide was determined by the action of alkali hydroxides on the chloride, nitrate, and sulphate. The results are as follows.

Hg_2 liq. + Cl_2 gas = Hg_2Cl_2 sol.	develops	+62·63 Cals.
Hg_2 liq. + Br_2 liq. = Hg_2Br_2 sol.	,,	+49·05 ,,
Hg_2 liq. + I_2 sol. = Hg_2I_2 sol., yellow amorphous	,,	+28·85 ,,
Hg_2 liq. + I_2 sol. = Hg_2I_2 sol., yellow-green amorphous	,,	+28·55 ,,
Hg_2 liq. + O gas = Hg_2O sol.	,,	+22·17 ,,

C. H. B.

Nature and Cause of Osmotic Pressure. By Ettore Molinari (*Gazzetta*, 1895, **25**, i, 190—205).—The author gives a brief outline of our present knowledge respecting the nature and cause of osmotic pressure, and then endeavours to explain the phenomena involved, by the following analogy. Suppose a vessel containing under unit pressure a gas A, which cannot penetrate or diffuse through the walls, to be immersed in an atmosphere of a second gas B, also under unit pressure, which, however, has the property of diffusing through the walls of the vessel; the gas B will diffuse into and out of the vessel, until at length as many molecules of B will leave the vessel as enter it in unit time. When this stage is reached, equilibrium is, of course, established between the inside and outside of the vessel, although the total pressure inside the vessel, being the sum of the partial pressures of A and B, is greater than the pressure on the exterior. The behaviour of a sugar solution in a Pfeiffer's cell is quite similar to this, the sugar and solvent taking the places of the gases A and B respectively; the author further argues that the sugar molecules, which are in a state resembling that of a gas, check the free exit of the water molecules to an extent proportional to the concentration of the solution, so that the osmotic pressure is also proportional to the latter. W. J. P.

Determination of Isosmotic Concentrations. By S. G. Hedin (*Zeit. physikal. Chem.*, 1895, **17**, 164—170).—The author has for many years used a method and apparatus similar to that described by Köppe (this vol., ii, 208). He obtained also the same general results as Köppe, and gives a table of his own numbers for the isosmotic concentrations of cane sugar; sulphates of potassium, sodium, and magnesium; nitrates of potassium, sodium, calcium, strontium, and barium; chlorides of sodium, potassium, calcium, and barium; bromides and acetates of sodium and potassium; sodium phosphate, potassium tartrate, and potassium ferrocyanide. These numbers are compared with those of Köppe, De Vries, Hamburger, Raoult, Arrhenius, Kohlrausch, van't Hoff and Reicher, and Gregory. They are in general higher than those of the three first named observers, but agree better with the results obtained by the freezing point and conductivity methods. The most notable differences are for sodium phosphate (3·12, Köppe, 2·24) and potassium ferrocyanide (2·53, Köppe, 1·72). The method is, he considers, available for a large number of compounds, but not for ammoniacal salts, acids, alkalis, or alkali carbonates. L. M. J.

Increase of Solubility by the Addition of Non-electrolytes. By HEINRICH GOLDSCHMIDT (*Zeit. physikal. Chem.*, 1895, **17**, 145—163). —The solubility of an anhydrous compound is affected to only a slight extent, if at all, by the addition of a non-electrolyte. As, however, this addition lowers the transition point from a hydrated to an anhydrous salt, it must in general cause an increase of solubility of the former, and an expression for this increase is theoretically deduced, it being independent of the nature of the non-electrolyte. This conclusion, and the expression, is tested by experiments on the solubility of sodium paranitrophenoxide in pure water, and in equimolecular solutions of carbamide, glycerol, acetone, ethylic cyanide, methylic cyanide, and urethane. The compound crystallises in two forms, the first with $2H_2O$, the other with $4H_2O$. The transition temperature was found by the dilatometric method to be 36°, and by the solubility method, 35·78°. Each non-electrolyte caused an increase in solubility of both hydrates, the molecular increase being approximately equal for all the compounds except urethane. Ethylic alcohol caused practically no alteration of the solubility. The lowering of the transition point is calculated according to the theoretical deductions to be 2·09°. The solubility experiments lead to the following results. Urea, 2·36°; glycerol, 1·91°; acetone, 1·67°. The agreement between the theory and the experiments is further tested by the comparison of the calculated and found values for the ratio of the molecular increases in solubility of the two hydrates, the results being carbamide, 1·017; glycerol, 1·019; acetone, 1·022; urethane, 1·015; calculated, 1·022.

L. M. J.

The Determination of Molecular Weights. By ERNST BECKMANN and AUGUST STOCK (*Zeit. physikal. Chem.*, 1895, **17**, 107—135; see this vol., ii, 154).—As values varying from I_1 to I_2 had been obtained for the molecular weight of iodine in solution by different observers, fresh determinations were made by the authors. The first set of experiments were made by the freezing point method, and gave the following results.

Solvent.	Colour of solution.	Mol. weight.
Benzene	red	355
Paraxylene	red	256
Ethylene bromide	red	244
Bromoform	red	276
Naphthalene	red	245
Acetic acid	brown	256
Urethane	brown	256

With the exception of that in benzene, therefore, all the numbers correspond with the formula I_2. The cause of the abnormal result in benzene solutions was afterwards investigated, and the authors consider that a solid solution is probably formed. Experiments with bromoform and iodine in solution were therefore performed, and from the analysis of the precipitated crystals the quantity of iodine present as a solid solution is estimated. Corrections applied on this account lead to the value 228 for the molecular weight of iodine in benzene solutions.

The next series of experiments were made by the boiling point method, but the ordinary formula for the estimation of the molecular weight cannot be used, owing to the volatility of the iodine. A formula applicable is therefore deduced, in which corrections for the iodine volatilised are applied. The molecular weights obtained thus are as follows.

Solvent.	Colour of solution.	Mol. weight.
Chloroform	violet	229
Ethylenic chloride	red	212
Benzene	red	244
Ethylic alcohol	brown	235
Methylic alcohol	brown	207
Methylal	brown	226
Acetone	brown	211
Carbon tetrachloride	violet	235

Experiments were also made on the effect of lead and mercury on solutions of iodine in chloroform, when the iodine is almost completely precipitated as iodides, chiefly iodide of mercury, which, however, slowly reacts with the lead. The solubility of mercuric iodide in various solvents is also recorded, and a short note added on the results of Krüss and Thiele (Abstr., 1894, ii, 415), and also on Behrend's experiments on the picrates of phenanthrene and anthracene, which the author considers do not necessitate the existence of molecular complexes (Abstr., 1892, 1385). L. M. J.

Physical Properties of Solutions of Lithium Chloride in Amylic Alcohol. By Launcelot N. Andrews and Carl Ende (*Zeit. physikal. Chem.*, 1895, **17**, 136—144).—The authors determined the viscosity, specific refraction, conductivity, and dissociation coefficient for solutions of lithium chloride in amylic alcohol at 17 concentrations, varying from 0·537 to 4096 litres per gram mol., the results being recorded in tables. Curves are also drawn, showing the variation with dilution in the case of the conductivity, refraction, and dissociation. The molecular weight was also determined by the boiling point method, the value being 71·5 in the concentrated solutions, but falling to 40 by sufficient dilution, owing probably to the presence of Li_2Cl_2, or other aggregates, in the concentrated solutions.

L. M. J.

Formation of Crystals at the bottom of a Solution heavier than themselves. By Paul E. Lecoq de Boisbaudran (*Compt. rend.*, 1895, **120**, 859—860).—The author has previously discussed cases in which certain substances crystallise at the surface of solutions lighter than themselves, the substances contracting on crystallising from their highly saturated solutions and expanding when they dissolve in liquids highly charged with certain other substances (*Compt. rend.*, 1895, **120**, 539). It would seem that substances which expand notably when they crystallise from highly saturated solutions, or which contract on dissolving in liquids charged with certain other substances, might crystallise at the bottom of liquids heavier than themselves. The phenomenon can, in fact, be observed with hydrated sodium sulphate and with ice.

If crystals of the hydrate $Na_2SO_4 + 10H_2O$ are allowed to float on the surface of a solution of sodium iodide saturated with sodium sulphate, and with a sp. gr. somewhat higher than the sodium sulphate crystals, after a few days the crystals of the sulphate collect at the bottom of the vessel round a fragment of the solid previously fixed there.

For ice, a solution of ammonia must be used of such strength that a fragment of ice neither increases in it nor melts at $-3·5°$. Fragments of ice are allowed to float on the liquid, and a fragment is fixed to the bottom of the vessel, the temperature being kept at $-3·75°$ to $-3·25°$, but never falling to $-4·0°$ nor rising to $-3·0°$. After some hours, the ice has passed to the bottom of the liquid.

C. H. B.

Law of Mass Action. By Joseph E. Trevor (*Amer. Chem. J.*, 1895, **17**, 372—374).—The author seeks to bring the derivation of the law of mass action from the principles of thermodynamics into a more simple and general form. The law has hitherto found application only in cases in which the free energy of a change in concentration is proportional to the absolute temperature at which the change occurs, and the well-known relation $pv = RT$ follows. The letters denote successively the actual pressure, the molecular volume, the gas-constant, and the absolute temperature. Let a chemical equilibrium be established between the initial components A_1, A_2, &c., and the products a_1, a_2, &c., which they unite to form; let the above relation hold for all constituents, and the equilibrium be represented by the chemical equation

$$N_1A_1 + \ldots = n_1a_1 + \ldots$$

At equilibrium, the free energy F developable by this system must be a maximum, so for a virtual displacement in the positive direction of change

$$\delta F = 0$$

$$\delta F \equiv \Sigma n \cdot v \delta p - \Sigma N V \cdot \delta P = 0,$$

the two terms of the left-hand member of the equation being summated over all the initial components (capitals) and their products (small letters) respectively. Substituting the molecular concentrations c and C in the state of equilibrium,

$$\delta F \equiv RT(\Sigma n \delta \log c - \Sigma N \delta \log C) = 0.$$

The work value of the process, the limiting value of F for the change considered as occurring isothermally at its equilibrium, is obtained by integration of this virtual change over the entire transformation of n_1, &c., mols.,

$$F = RT \int (\Sigma \delta \log c^n - \Sigma \delta \log C^N),$$

the constant of integration disappearing from the definite integral. This becomes

$$F = RT \log K,$$

when the change is conducted in the positive direction, and K is set for the ratio $\Pi c^n / \Pi C^N$. And since F must be constant for a given isothermal change, this ratio must be constant also, which is the law of mass action. H. C.

The Velocity of Formation of Amines and of Alkylic Ammonium Salts. By N. Menschutkin (*Ber.*, 1895, **28**, 1398—1407).—The alkylic bromide (1 mol.) and the amine (2 mols.) were heated with benzene (15 vols. to one of the mixture) at 100° in sealed tubes, and the amount of hydrobromide formed was estimated by titration with silver solution according to Mohr's method. The equation $dx/dt = (A - x)(B - x)c$ represents the reaction, and as $A = 2B$,

$$c = \log \frac{A - x/2}{A - x} \cdot \frac{1}{t}.$$

The following are the results.

I.

	$c \times 10^6$.		$c \times 10^6$.
$NHMe_2 + MeBr$ =	59954	$NH_2Pr + MeBr$ =	15215
$NMe_3 + MeBr$ =	47437	$NHPr_2 + MeBr$ =	10264
$NH_2Me + MeBr$ =	31910	$NH_3 + MeBr$ =	5471
$NH_2Et + MeBr$ =	19377	$NEt_3 + MeBr$ =	5380
$NHEt_2 + MeBr$ =	16886		

II.

	$c \times 10^6$.		$c \times 10^6$.
$NMe_3 + C_3H_5Br$ =	34263	$NH_2Pr + C_3H_5Br$ =	3783
$NHMe_2 + C_3H_5Br$ =	30833	$NHPr_2 + C_3H_5Br$ =	2910
$NH_2Me + C_3H_5Br$ =	8302	$NH_3 + C_3H_5Br$ =	1380
$NH_2Et + C_3H_5Br$ =	3807	$NEt_3 + C_3H_5Br$ =	757

III.

	$c \times 10^6$.		$c \times 10^6$.
$NHMe_2 + EtBr =$	1534	$NHEt_2 + EtBr =$	182
$NMe_3 + EtBr =$	1053	$NH_3 + EtBr =$	124
$NH_2Me + EtBr =$	490	$NHPr_2 + EtBr =$	101
$NH_2Et + EtBr =$	214	$NEt_3 + EtBr =$	30
$NH_2Pr + EtBr =$	184		

IV.

	$c \times 10^6$.		$c \times 10^6$.
$NH_2Et + PrBr =$	65	$NHPr_2 + PrBr =$	21
$NH_2Pr + PrBr =$	60	$NPr_3 + PrBr =$	0·5
$NH_3 + PrBr =$	44		

With the exception of ammonia, which appears to be anomalous in its position, the amines follow the same order in each series, the di- and tri-methylamine being by far the strongest bases.

The author shows that the velocity of formation of a mixed amine depends on the order in which the different alkylic groups are introduced. Thus, with NHMeEt—

	$c \times 10^6$.
(1.) $2NH_2Me + EtBr = NHMeEt + NH_2Me,HBr =$	490
(2.) $2NH_2Et + MeBr = NHMeEt + NH_2Et,HBr =$	19377

and similarly with piperidineethylallyl bromide,

$$(C_5H_{10})(C_2H_5)(C_3H_5)NBr.$$

It is further shown in the latter case that the final product itself is independent of the order in which the alkylic groups are introduced.

From the tables, it follows that the displacement of one of the hydrogen atoms of ammonia by (1) a methyl group increases the velocity to a considerable extent, namely, 25439; (2) an ethyl group only to a slight extent, namely, 90; and (3) a propyl group does not appreciably increase the velocity. It is further shown that the capability of nitrogen compounds to form derivatives in which the nitrogen atom is quinquivalent depends largely on the nature of the elements or groups to which the nitrogen atom is already united.

J. J. S.

Determination of the Affinities of Acids colorimetrically by means of Potassium Dichromate. By J. H. KASTLE and B. C. KEISER (*Amer. Chem. J.*, 1895, **17**, 443—449).—This method depends on the fact that potassium dichromate is converted into normal chromate by the alkali salts of feeble acids, the extent of the change being indicated by the variation of the colour of the dichromate towards that of the chromate. Since it is impossible to prepare a normal solution of potassium dichromate, and since the addition of a decinormal solution of an alkali salt to a decinormal solution of the dichromate causes too slight a change of colour for accurate measurement, it was necessary to use decinormal dichromate and normal alkali salt. One c.c. of the N/10 dichromate is mixed in a thin glass cylinder (30 c.c. capacity) with 10 c.c., or other suitable quantity, of the N alkali salt of the acid whose affinity is to be determined. In a similar cylinder, 1 c.c. of the N/10 dichromate is diluted with water to nearly the same volume, the equality being perfected by the addition of N/10 soda solution, added drop by drop until the colour of the liquids in the two cylinders is identical. The method of calculating a number to express the affinity of the acid when that of potassium dichromate is called 1 may be understood from the following example.

1·5 c.c. N/10 caustic soda was required to produce the same colour as 10 c.c. of N sodium acetate solution; this quantity of NaOH is equivalent to 0·0123 gram of $NaC_2H_3O_2$, which is, therefore, the quantity of sodium acetate which has been decomposed by the dichromate; calculated to a percentage on the sodium acetate used, the number becomes 1·5, and if the affinity of the dichromate be called 1, that of acetic acid under the conditions of this experiment is $1 \times \frac{100 - 1{\cdot}5}{1{\cdot}5} = 65{\cdot}6$.

The numbers obtained in this way, at different degrees of dilution, are given hereunder.

	c.c. of normal solution.				
	5.	7.	10.	15.	20.
Acetic	44·0	53	65·6	90·7	116
Formic	—	—	153·0	—	199
Butyric	30·2	39	—	—	—
Benzoic	—	—	124·0	—	—
Crotonic	51·6	—	74·6	102·0	128
Monobromacetic	—	—	399·0	—	665

It will be noticed that essentially the same relation exists between the numbers obtained for one quantity of the several salts used and those obtained for other quantities.

It is shown in a table that the authors' results give figures which bear a ratio to each other similar to that which exists between the numbers obtained by other methods of investigating relative affinity.

A. G. B.

Apparatus for Fractional Distillation. By Paul Monnet (*Bull. Soc. Chim.*, 1895, [3], **13**, 108—114).—A column of beads, about 135—140 cm. high, and 28—35 mm. in diameter, resembling Hempel's well-known device. The beads may be of glass, but consist preferably of various sizes of lead shot, graduated from large below to small above, and separated by copper gauze diaphragms to facilitate removal for cleaning. By the use of this apparatus, 90 per cent. alcohol can be separated from a comparatively small amount—300 c.c. —of 50 per cent. spirit in one operation, and such mixtures as benzene and toluene, and aniline and orthotoluidine, can be satisfactorily and completely resolved into their constituents. Jn. W.

Inorganic Chemistry.

Absorption of Hydrogen by Palladium. By C. Hoitsema (*Zeit. physikal. Chem.*, 1895, **17**, 1—42).—The researches of Troost and Hauteville had led those chemists to the conclusion that the absorption of hydrogen by palladium is accompanied by the formation of a compound represented by Pd_2H. The author undertook researches to further investigate this question, and, after a short consideration of the conditions of equilibrium between a solid and gas, gives a description of the apparatus which was used in his experiments. The quantity of hydrogen absorbed by a known weight of the metal, and the pressure of the gas, were determined with varying quantities of hydrogen at every 10 degrees between 20° and 200°, and from these results the isothermal curves are drawn with pressure ordinates, and the atomic ratios of the absorbed hydrogen and the palladium, as abscissæ. Some similar numbers, due to Roozeboom, but previously unpublished, are also added. The curves show the same essential features, and, although small differences are observed to follow the use of different varieties of metal, the agreement between the results is very satisfactory; the pressure at first increases with the hydrogen content, then a second position is reached where the curve is nearly horizontal, the pressure increasing only very slowly, and in the final portion the pressure again rapidly rises. The length of the central portion of the curve diminishes as the temperature rises, but had not disappeared in any of the experiments. There are no sudden breaks, the three portions being continuous. The author considers the slow increase of pressure in the middle part to be an essential feature, and not due to accidental impurities, &c., and the curves do not support the supposition of the formation of the compound Pd_2H. He considers they are better explained by the assumption of two non-miscible solid solutions, and further draws attention to the similarity between these and liquefaction curves, so that the experiments could be explained by the supposition that a kind of liquefaction of hydrogen takes place, for which the critical temperature is far higher than that of hydrogen in ordinary conditions. The molecular state of the gas is also calculated, and, though at first represented by H_2, the gas appears above 100° to be monatomic, the expression $pv/\sqrt{p}$ having an approximately constant value. L. M. J.

Argon and Fluorine. By Henri Moissan (*Compt. rend.*, 1895, **120**, 966—968).—Titanium, boron, lithium, and uranium are not affected when heated in argon.

Argon and fluorine do not combine either at the ordinary temperature or under the influence of an electric spark. C. H. B.

Combustion in Nitrogen. By Friedrich Emich (*Ber.*, 1895, **28**, 1585).—The author points out that the combustion of titanium in nitrogen described by Moissan (this vol., ii, 272), is not the first instance of the kind, since Prelinger (this vol., ii, 16) has previously described the similar behaviour of metallic manganese. A. H.

Thiohypophosphates. By L. FERRAND (*Bull. Soc. Chim.*, 1895, [3], **13**, 115—117).—Zinc, cadmium, and nickel thiohypophosphates can be prepared by Friedel's method, namely, by heating the metal or its sulphide to redness for 40 hours or more with sulphur and phosphorus in sealed tubes imbedded in iron tubes filled with sand. The *zinc* salt, $Zn_2P_2S_6$, crystallises in small, transparent, yellow plates, apparently hexagonal; it is insoluble in cold water, and in hydrochloric or nitric acids, but is partially decomposed by boiling water, and entirely by nitrohydrochloric acid; sp. gr. = 2·2. The *cadmium* salt forms orange-yellow, biaxial crystals. The *nickel* salt, prepared from the sulphide, forms very brilliant, grey, hexagonal crystals, and is scarcely attacked by nitrohydrochloric acid; sp. gr. = 2·4.

JN. W.

New Method for Preparing Alkali Metals. By NICOLAI N. BÉKÉTOFF and SCHERBATSCHEFF (*Chem. Centr.*, 1895, i, 145; from *Bul. Acad. St. Pétersb.*, 1894, [5], i).—The alkali metals may be prepared by Winkler's process of distilling their aluminates with magnesium; the authors prepare metallic cæsium by removing the sulphuric acid from cæsium alum by baryta, adding aluminium hydroxide to the filtered solution, evaporating in an iron or nickel dish, and heating the residue to redness. The product, which is scarcely hygroscopic, is distilled from an iron tube with the requisite weight of magnesium, the cæsium being collected in a glass vessel.

Cæsium thus obtained has the density 2·366, not 1·88 as found by Settler; its atomic volume is consequently 56, a much more probable value than the older one of 75. W. J. P.

Acid Fluorides of Potassium and Silver. By ANTOINE GUNTZ (*Bull. Soc. Chim.*, 1895, [3], **13**, 114—115).—The heat of formation of ordinary potassium hydrogen fluoride (solid) from its proximate constituents (solid and gaseous) is 21·1 cals. The heats of dissolution of the di- and tri-hydrogen fluorides, KF,2HF, and KF,3HF, are −8·0 and −8·6 cals. respectively, whence the heats of formation of these latter (solid) from potassium fluoride (solid) and hydrogen fluoride (liquid) are +6·5 and +11·6 cals. The heat liberated by the addition of 1 mol. of hydrogen fluoride (liquid) to potassium fluoride and the mono- and di-hydrogen salts respectively (solid) is +13·9, +6·5, and +3·1 cals. The stability of these double fluorides thus decreases on ascending the series. Cryoscopic determinations with the two higher salts show that they are almost completely dissociated in aqueous solution.

Silver trihydrogen fluoride, AgF,3HF, is obtained in colourless, fuming crystals by dissolving silver fluoride, or, more conveniently, silver subfluoride in aqueous hydrofluoric acid; the action is strongly exothermic, the heat of formation of the salt being about +2·0 cals. The double fluoride is very unstable, as its vapour pressure is considerable at ordinary temperatures, and on exposing it to a current of dry air, even at 0°, it is converted into the monhydrogen fluoride.

JN. W.

An Alcoholate of Calcium Bromide. By FERDINAND ROQUES (*J. Pharm.*, 1895, [6], **1**, 301—303).—Fused calcium bromide is powdered and placed, whilst still hot, in a flask and covered with pure absolute alcohol. Much heat is developed, and a small quantity of free lime separates. The solution is diluted with some more alcohol and filtered into a dish through a filter large enough to hold all the liquid at once, and the whole is then placed under a large desiccator containing sulphuric acid.

In the author's experiment, the crystals had formed after a lapse of four months. They were quickly dried between filter-paper, and, on analysis, gave figures corresponding with the formula $CaBr_2,3C_2H_6O$. The crystals are very large, rhomboid tables, easily cleavable, very hygroscopic, and readily take fire. When calcined to remove the alcohol, they are partly decomposed into free lime, ethylic bromide, and hydrogen bromide.

L. DE K.

Purification of Zinc. By FRANZ MYLIUS and OTTO FROMM (*Ber.*, 1895, **28**, 1563—1575, and *Zeit. anorg. Chem.*, 1895, **9**, 144—177).—Ordinary purified zinc contains lead, iron, and cadmium in amounts varying from 2 to 111 parts per 100,000 according to the quality of the sample. The purest specimens which were purchased by the authors, and were called "specially pure," contained 5 parts of lead, 16 of cadmium, and 1·4 of iron per 100,000. Zinc can readily be freed from lead and cadmium by crystallisation, these impurities remaining in the mother liquor, but not from iron, which tends to accumulate in the crystals. Is is best purified by electrolysis in basic zinc sulphate solution. The process must be frequently repeated, the spongy mass which is obtained at the cathode being formed into the anode for the next operation. The final product is melted in a porcelain crucible and distilled in a vacuum. It then contains less than 1 part of impurity per 100,000; compact zinc, obtained by the use of platinum electrodes, contains about 1/100 per cent. of platinum.

A. H.

Synthesis of Minerals and analogous Metallic Compounds by Crystallisation from Molten Metals. By FRIEDRICH ROESSLER (*Zeit. anorg. Chem.*, 1895, **9**, 31—77).—Silver sulphide in varying proportions was dissolved in silver under borax and allowed to cool slowly. The cornets obtained have a coarser fracture and darker colour the more silver sulphide they contain. With 20 per cent. and more of silver sulphide the cornet separates into two layers, and the layer of silver contains dark particles of sulphide. When the cornets are treated with dilute nitric acid, the silver sulphide is obtained in lustrous, black particles. A cornet containing 2 per cent. of silver sulphide, when etched with dilute nitric acid, showed the sulphide arranged in lines of rounded particles. The silver sulphide, which has a lower melting point than silver, is fluid when it separates from the solution, so that it cannot be obtained crystalline by this method. Silver selenide dissolved in silver behaves in the same way as the sulphide. The sulphide and selenide, although they do not separate in crystals, have the same composition and physical properties as the naturally occurring minerals.

Sulphide of lead crystallises from lead in beautiful cubes, sometimes arranged in steps or needles; when treated for some time even with dilute nitric acid, it is partially decomposed, and the crystals are best separated from the matrix by electrolysis, using a solution of lead acetate, sodium acetate, and acetic acid in water, and a current density of 0·2—0·3 ampère. Lead selenide also crystallises well from lead in beautiful cubes or aggregates of cubes; the crystals are best separated from the matrix by electrolysis, but even then it is difficult to obtain them pure.

When sulphur is melted with bismuth under borax, a dark coloured dross is formed containing sodium sulphide. Bismuth sulphide may be easily crystallised by dissolving the previously prepared compound in bismuth and allowing the solution to cool. It dissolves in bismuth in all proportions, crystallises in long needles identical with the natural compound, and is easily separated from the matrix by dilute nitric acid. Bismuth selenide crystallises from bismuth in rhombohedral tablets or regular octahedra; the crystals are not identical with those of natural bismuth selenide; they are difficult to separate from the matrix, and gave on analysis numbers agreeing with the composition Bi_2Se.

Silver bismuth sulphide, Ag_2S,Bi_2S_3, is obtained when silver sulphide is dissolved in bismuth, and the cornet then treated with dilute nitric acid. It crystallises in beautiful groups of octahedra, has the same composition as the natural mineral, but not the same crystalline form. Silver selenide crystallises from bismnth in four-sided columns.

Cuprous sulphide and selenide crystallise from lead, the former in beautiful octahedra, the latter in reddish-yellow and steel-blue octahedra and feathery aggregates. The author was unable to prepare zorgite, $PbSe,Cu_2Se$, or emplectite, Cu_2S,Bi_2S_3.

Palladium sulphide, Pd_2S, is obtained by melting palladium ammoniochloride with sulphur under borax. It is a greyish-yellow, crystalline mass, and so hard that it is scarcely scratched by steel. When melted with palladium under glass, it yields a cornet, which, after treatment with concentrated nitric acid, yielded irregular, grey, metallic particles very similar to those of the platinum earths.

Palladium selenide, PdSe, obtained in a similar manner to the sulphide, melts at a lower temperature than silver, and is completely soluble in aqua regia. When melted with palladium, it yields grey, irregular particles similar to the sulphide. These particles on analysis gave numbers agreeing with the composition Pd_4Se.

The author was unable to prepare platinum sulphide by melting together platinum and sulphur.

Platinum selenide, PtSe, is easily obtained by melting platinum and selenium together under borax. A dark grey, lustrous cornet is obtained which breaks into lustrous plates on gently hammering it. When melted with platinum, it forms bright particles.

Antimony platinum, $PtSb_2$, is obtained by melting antimony (400 grams) with platinum powder (10 grams) and then dissolving the matrix in a mixture of equal parts of nitric acid and tartaric acid. It crystallises in dark grey, lustrous cubes and octahedra, and is very hard and brittle.

Bismuth platinum, $PtBi_2$, obtained in a similar way to the preceding compound, crystallises in dark grey, brown, and blue plates, and is very brittle.

Antimony palladium, $PdSb_2$, was not obtained crystalline. On treating the cornet with acid, small grey particles were obtained which had evidently been attacked by the acid.

Bismuth palladium, $PdBi_2$, crystallises in small, interlacing needles.

Bismuth gold, Au_3Bi, is obtained by dissolving gold in a large excess of bismuth. It crystallises in very small, grey crystals, sometimes in minute octahedra.

Antimony gold crystallises in small, grey crystals which turn red or bronze colour when dissolved out with acid. It has probably the composition Au_3Sb. E. C. R.

Action of Halogen Compounds of Phosphorus on Copper. By A. GRANGER (*Compt. rend.*, 1895, **120**, 923—924).—When copper is heated at 300° in sealed tubes with phosphorus trichloride or tribromide, copper phosphide is formed, but cannot be separated from the cupric chloride or bromide. With phosphorus biiodide, under similar conditions, the metal is only imperfectly attacked.

When carbonic anhydride charged with vapour of phosphorus trichloride, tribromide, or biiodide is passed over gently heated copper, the biphosphide, CuP_2, is obtained as a crystalline solid with a colour and lustre resembling that of silicon. It is readily attacked by chlorine, bromine, or nitric acid, and more slowly by hydrochloric acid. When heated out of contact with air, it yields cupric phosphide and phosphorus; heated in presence of air, it oxidises, and when mixed with oxidising agents such as potassium chlorate, it detonates when struck.

Phosphorus trifluoride, under similar conditions, yields the phosphide, Cu_5P_2, previously described (Abstr., 1892, 410).

C. H. B.

Copper-Aluminium Alloys: a Correction. By HENRI L. LE CHATELIER (*Compt. rend.*, 1895, **120**, 1050—1051).—The alloy described as AlCu (this vol., ii, 351), and said to be superficially attacked by the potash solution, has really been more or less completely attacked. The definite compound contains a higher proportion of aluminium, and although the author's researches on the fusibility of copper-aluminium alloys indicate the existence of two definite compounds, Al_2Cu and $AlCu_3$, this conclusion requires confirmation by other methods.

The peculiar manner in which aluminium alloys undergo alteration may have led to many erroneous conclusions. In one case, an ingot obtained by fusing equal weights of copper and aluminium was left for 24 hours in a sodium chloride solution containing lead chloride, in order to dissolve the free aluminium. There seemed to be no action, and the ingot retained its original appearance, but after being washed, dried, and exposed to the air for about 12 hours, it changed spontaneously to a small heap of blackish powder, whereas another piece of the same alloy, which had not been treated with sodium chloride solution, remained quite unaltered for at least a month.

C. H. B.

Hydrolysis of Aqueous Solutions of Mercuric Chloride. By Henryk Arctowski (*Zeit. anorg. Chem.*, 1895, **9**, 178—189).—When a rod of marble is allowed to remain in an aqueous solution of mercuric chloride, carbonic anhydride is formed by the action of the acid liberated by the hydrolysis of the mercuric chloride. At the same time crystalline basic salts are deposited. The composition of these salts depends on the temperature, concentration of the solution, and the ratio of the area of the rod of marble to the bulk of solution. An aqueous solution of mercuric bromide behaves in the same way, but less basic salts are formed. Mercuric iodide is not hydrolysed at the ordinary temperature, and at 170° only a very small quantity of basic salt is formed. The salt $HgCl_2,3HgO$ is obtained by heating a 5 per cent. solution of mercuric chloride for one month at 80°; the salt $HgCl_2,4HgO$ by heating the solution at 100°. The salt $HgCl_2,4HgO$ is formed in very small quantity together with the salt $2HgCl_2,HgO$ at the ordinary temperature. The oxychlorides obtained are only stable in the neutral salt solution, and are decomposed by water into mercuric chloride and oxide. They are not decomposed to any extent by alcohol. The formation of basic salts is not due to the slight solubility of the calcium carbonate in water, for when three sealed tubes containing marble, mercuric chloride and water, alcohol, and ether respectively were heated at 96° for 120 hours, and then at 110—125° for three hours, oxychlorides were formed only in that tube containing water. Oxychlorides were also obtained by heating mercuric chloride with water only at 210° for 48 hours.

E. C. R.

Cerite Earths. By Paul Schützenberger (*Compt. rend.*, 1895, **120**, 962—966).—The first and most abundant crystallisations of cerium sulphate (this vol., ii, 352), when subjected to repeated fractional crystallisation, yield a product of constant composition, which gives the following results for the atomic weight of cerium:—By conversion into dioxide at a cherry-red heat, $Ce_1 = 139·5$; by analysis with barium chloride (*loc. cit.*), $Ce_1 = 139·5$; conversion into dioxide at a bright red heat, $Ce_1 = 129·0$ to $138·8$. The synthesis of the sulphate from the dioxide obtained by heating the oxalate in air yields results which vary with the temperature at which the oxalate has been heated; at a dull redness, $Ce_1 = 142$ to 143; at a cherry-red heat, $Ce_1 = 139·7$; at a bright red heat, $Ce_1 = 139·0$ to $138·8$.

The sulphate precipitated by alcohol from the last mother liquors and purified by recrystallisation yields different results, and may be distinguished as Ce_2. It is free from yttrium, didymium, and lanthanum, and forms with potassium sulphate a double salt quite insoluble in a saturated solution of potassium sulphate. When precipitated with barium chloride, $Ce_2 = 138·75$, whereas the various synthetical methods give Ce_2 = 135·7 to 142·5 according to the temperature at which the oxide was heated. It is noteworthy that the values obtained for Ce_1 by precipitation of the sulphuric acid with barium chloride and by heating the sulphate at a cherry-red heat are practically identical, whereas, in the case of Ce_2 there is a considerable difference; it would seem that the oxide of Ce_2 is more readily decomposed on heating.

The final mother liquors obtained in the preparation of the cerium sulphate yield a product which may be distinguished as Ce_3. Precipitation with barium chloride gives Ce^3 = 137·1, whilst the synthetic method gives Ce^3 = 142·4, and the action of heat on the sulphate Ce = 128 to 130.

It follows from these results that in cerite, cerium is accompanied by small quantities of another metal of lower atomic weight which forms a sulphate isomorphous with cerium sulphate, and a dioxide which has a distinctly reddish colour, and seems to be more readily decomposed by heat than cerium dioxide. C. H. B.

Amalgamated Aluminium as a Reducing Agent. By JULIUS B. COHEN and REGINALD ORMANDY (*Ber.*, 1895, **28**, 1505—1506).—The authors point out that the reducing properties of amalgamated aluminium, which form the subject of a recent paper by Wislicenus and Kaufmann (this vol., i, 437), were described by them in 1889 (*Brit. Assoc. Rep.*, 1889, 550), and that the application of this reducing agent to water analysis formed the subject of a paper published in the Journal of the Chemical Society (Trans., 1890, 811). They are at present engaged in the further study of the properties of the amalgam as a reducing agent. A. H.

Manganese Compounds. By CHARLES LEPIERRE (*Compt. rend.*, 1895, **120**, 924—926).—The compound $(NH_4)_2SO_4,2MnSO_4$ is obtained by adding crystallised manganous sulphate to about five times its weight of fused ammonium sulphate. The fused salt is decanted off from the crystals, and the latter are purified by treatment with boiling alcohol of 70°. They are white or pale yellow, anhydrous, and somewhat bulky, and belong to the cubic system; sp. gr. = 2·56 at 14°, which is practically the mean sp. gr. of the constituents. The double salt is readily decomposed by water.

Anhydrous manganous sulphate is obtained crystallised by heating the preceding salt at 350° alone or in presence of the mother liquor, the excess of ammonium salt being expelled below a dull red heat. The crystals are very hygroscopic; sp. gr. = 3·14 at 12°.

It will be observed that manganese behaves like nickel and cobalt (Abstr., 1892, 1282), and does not, like iron (Abstr., 1892, 943), yield more highly oxidised compounds.

The salt $(NH_4)_2SO_4,Mn_2(SO_4)_3$, or anhydrous manganese alum, is formed on adding a mixture of equal volumes of nitric and sulphuric acids to the preceding double salt in presence of excess of the ammonium compound, and separates in violet-brown, hexagonal crystals, which can be purified by treatment with hot concentrated sulphuric acid, glacial acetic acid, and, finally, dry ether. The crystals (sp. gr.

= 2·40 at 11°) are decomposed by water with formation of pseudomorphic manganic oxide; they are insoluble in ether, benzene, and concentrated sulphuric acid, but dissolve in a mixture of equal volumes of sulphuric acid and water. When heated alone or in the liquid in which it was formed, the double salt decomposes with evolution of sulphuric anhydride and oxygen, and formation of the manganous ammonium sulphate.

By adding ferric, chromic, or aluminium sulphates, or potassium, sodium, and, perhaps, thallium sulphates, mixed anhydrous manganese alums can be obtained similar to those described by Klobb (Abstr., 1893, ii, 572).

When hydrated manganous sulphate is fused with 10 times its weight of potassium nitrate for several hours, the oxide $MnO,5MnO_2$ is obtained in crystals of sp. gr. 3·41. Under similar conditions, manganous carbonate yields the oxide Mn_2O_3 in a confusedly crystalline form, and manganous nitrate yields the oxide $MnO,3MnO_2$.

C. H. B.

Action of Ferric Chloride on Metallic Iodides. By KARL SEUBERT and KARL GAAB (*Zeit. anorg. Chem.*, 1895, **9**, 212—227).—The quantity of iodine liberated by the action of ferric chloride on the different iodides is approximately equal, and the curves illustrating the action are very similar. Disregarding small anomalies, the following iodides are arranged according to the ease with which they are decomposed—ferric iodide, cadmium iodide, zinc iodide, potassium iodide, lithium iodide, magnesium iodide, calcium iodide, sodium iodide, strontium iodide, barium iodide, manganese iodide, ammonium iodide, aluminium iodide. Aluminium iodide shows a great anomaly; it gives a 5 per cent. higher decomposition than the other iodides and is the only iodide, except hydrogen iodide, which when employed in excess with ferric chloride liberates the theoretical quantity of free iodine. This point is reached in the case of hydrogen iodide at 15 equivalents, in the case of aluminium iodide at seven equivalents for one equivalent of ferric chloride. Considerably lower quantities of iodine are obtained with cadmium and ferric iodide when these are employed in excess. In the case of lithium iodide, the amount of iodine liberated increases until 5 mols. of iodide to one equivalent of ferric chloride are present, and then decreases again; at the same time basic salts are precipitated.

The final results obtained with an excess of iodide, and with an excess of ferric salt are very similar, the curves obtained, however, rise more gradually with an excess of ferric salt than of iodide as has already been shown for potassium iodide, and hydrogen iodide (*Zeit. anorg. Chem.*, **5**, 419). The decomposition with an excess of ferric salt gives the theoretical quantity of free iodine when 16 equivalents are present, whereas only 96·8 per cent. of the theoretical quantity of free iodine is obtained with 18 equivalents of iodide.

The influence of the base which is present in the iodide is, as a rule, very small, and very much less than the influence of the acid radicle in the ferric salt, which has already been shown in the case of ferric sulphate and acetate.

E. C. R.

Volatility of Chromic Anhydride. By HENRYK ARCTOWSKI (*Zeit. anorg. Chem.*, 1895, **9**, 29—30).—Chromic anhydride can be melted without decomposition, but on raising the temperature there is a violent evolution of oxygen together with red vapours which are apparently chromic anhydride. When perfectly dry chromic anhydride is heated in a vacuum for 20 hours at 110—130°, a small quantity is volatilised, and after heating at 125° for four days long, red needles of chromic anhydride were obtained. E. C. R.

Tungsten and Molybdenum and their Trioxides. By CHARLES H. EHRENFELD (*J. Amer. Chem. Soc.*, 1895, **17**, 381—397).—Tungsten trioxide, when heated with an equivalent weight of phosphoric chloride in an atmosphere of carbonic anhydride is converted into the hexa- and penta-chlorides, and phosphorous oxychloride is evolved. The product is red-brown, melts to a dark red liquid, and gives off reddish-brown vapours resembling bromine; these condense to steel-blue isometric forms of the hexachloride mixed with reddish-brown needles of the pentachloride. The intensity of the heat applied, and the duration of the action determine the quantity of the brown material produced. This is not surprising, since the hexachloride passes into the pentachloride by ignition in carbonic anhydride or hydrogen. The analysis of another, bright red, and more volatile product, showed it to be tungsten oxytetrachloride, $WOCl_4$. The same reaction takes place in an atmosphere of nitrogen, but less satisfactorily.

With a mixture of equivalent quantities of molybdenum trioxide and phosphoric chloride, the action takes place at a lower temperature, and is more rapid and energetic: molybdenum pentachloride is produced, mixed with small quantities of lower chlorides.

No action takes place when tungsten trioxide is heated with silicon tetrachloride in an atmosphere of carbonic anhydride. When a small quantity of air is introduced, tungsten oxytetrachloride and tungstyl chloride are formed. Silicon tetrachloride is likewise without action on molybdenum trioxide.

Action of various Gases on Tungsten and Molybdenum.—Tungsten and molybdenum trioxides remain unchanged when heated in a current of nitric oxide. When finely powdered tungsten is heated in a current of nitric oxide, the action commences below a red heat, and the substance becomes white hot. The product is tungsten trioxide. With molybdenum, the action is less energetic and molybdenum dioxide is produced. When heated with nitrous oxide, tungsten is converted into the trioxide, but the action is less energetic than with nitric oxide. Molybdenum when treated in the same manner, required a full red heat before any action took place, the product being molybdenum dioxide. With nitrogen peroxide and tungsten, action commences at about 300—350°, and then proceeds rapidly, the trioxide being formed. With molybdenum, the action begins at an incipient red heat, proceeds with more energy than in the preceding instances, and at once forms molybdenum trioxide. With sulphurous anhydride, tungsten is slowly oxidised at a moderately high temperature, lower tungsten oxides being formed and sulphur deposited. With molybdenum, the action takes place only at the highest temperature and molybdenum dioxide is formed. No action takes place when tungsten or molybdenum is heated in a current of methylamine.

Action of various Gases on Tungsten and Molybdenum Trioxides.—Tungsten trioxide, when heated in a current of ethylene, is slowly reduced at a red heat and water and carbon are formed; the product is a deep blue oxide which does not precipitate metallic silver from an ammoniacal solution. Molybdenum trioxide when treated in a similar manner yields a beautiful, bronze coloured, crystalline oxide which dissolves in an ammoniacal silver solution with deposition of metallic silver, and on analysis gave numbers agreeing with the formula, Mo_2O_5. When heated in a current of acetylene, tungsten trioxide is slowly reduced to a mixture of brown and blue oxides. Molybdenum trioxide is reduced much more readily, and the same bronze-brown oxide is obtained as with ethylene; underlying this oxide there is a shining, crystalline, metallic product, which the author believes to be a molybdenum carbide of the formula Mo_2C, or Mo_3C. Tungsten trioxide is not reduced by methane at the highest heat of a Bunsen burner, but at the full heat of a blast-lamp, the trioxide is reduced to the blue oxide, W_2O_5. Molybdenum trioxide is reduced at the ordinary heat of a Bunsen flame, the dioxide being formed; neither of the trioxides is affected by ethane. Tungsten trioxide, when heated with phosphine is reduced at about 125—150°; the product is a deep-blue oxide of the composition W_3O_8, and contains about 2 per cent. of phosphorus mechanically mixed with it. Molybdenum trioxides begin to show signs of reduction without the application of heat, and when gently heated the action proceeds rapidly; a beautiful lustrous purple oxide is formed which, on analysis, gives numbers agreeing with the formula, Mo_2O_5; it contains about 2 per cent. of phosphorus. Ammonia acts on tungsten and molybdenum trioxides more energetically, and the products are very complicated. With arsenic, the products are the same as with phosphine, but the reduction takes place much more sluggishly. As usual, molybdenum trioxide is the more readily reduced.

Reduction of the Trioxides by Magnesium, Zinc, and Aluminium.—Tungsten trioxide when heated with powdered magnesium is reduced to the dioxide; when the reaction takes place in an atmosphere of hydrogen, light is emitted and heat produced sufficient to crack the combustion tube. On analysis, the dark-gray product gave numbers agreeing with those required for the sesquioxide. Molybdenum trioxide, when treated in a similar way yields the sesquioxide if reduced in air, and the dioxide if reduced in hydrogen. With zinc and tungsten trioxide, the reduction takes place at about 300—400°, and in air a lower oxide, W_2O_5, is formed; in hydrogen the dioxide is formed. Molybdenum trioxide is reduced more readily, and in air the product is probably Mo_2O_5; in hydrogen, a brown mixture is formed which, on analysis, gave numbers agreeing with the composition Mo_4O_9. When tungsten trioxide is heated with aluminium in a tube sealed at one end, no action took place until a full red heat is reached, when there is a flash and slight report, cracking the tube and scattering its contents. With molybdenum trioxide, the action is similar, and the blue oxide, Mo_2O_5, is formed. When heated in hydrogen with aluminium, no action takes place, probably for the reason that the temperature required is so high that the trioxides are reduced by the hydrogen before the aluminium can act.

The above experiments show that there is a considerably stronger affinity between tungsten and oxygen than there is between molybdenum and oxygen.

Reduction of Ferric Chloride by Tungsten and Molybdenum.—Molybdenum reduces a solution of ferric chloride according to the equation, $6FeCl_3 + Mo = MoCl_6 + 6FeCl_2$. Complete reduction does not, however, take place in a reasonable length of time, except with small quantities of the metal; thus using 0·07857 gram molybdenum, only 97·10 per cent. of the molybdenum had gone into solution after 48 hours. With tungsten, a similar reduction takes place but the action is extremely slow; there is a gradual increase in the amount of iron reduced, roughly proportional to the time, but complete solution of the tungsten cannot be obtained. E. C. R.

New Source of Uranium. By NORDENSKIOLD (*Compt. rend.*, 1895, **120**, 859).—The author has discovered a bed of carbonaceous sedimentary rock, the ashes of which contain from 2 to 3 per cent. of uranium. It also contains a small quantity of nickel and rare earths, and a considerable quantity of nitrogen, and the author suggests that it may possibly be an abundant source of argon or helium.

C. H. B.

Double Halogen Salts of Caesium, Rubidium, Sodium, and Lithium with Thallium. By J. H. PRATT (*Zeit. anorg. Chem.*, 1895, **9**, 19—28).—The salts described in this paper belong to four types, caesium giving a more complete series than the other alkali metals. The ease of formation and the number of salts increases from the iodides to the chlorides. The salts with alkali metals of lower atomic weight are generally more easily soluble in water, form larger crystals, and contain more water of crystallisation.

3 : 1-*Caesium and rubidium thallium chlorides*, $Cs_3TlCl_6 + H_2O$, and $Rb_3TlCl_6 + H_2O$.—The caesium salt is obtained as a white precipitate when 0·25 gram of thallium chloride is added to a solution of 50 grams of caesium chloride; it dissolves on gently warming the solution, and crystallises in very slender needles. The conditions of formation are very narrow, as if 3 grams of thallium chloride are employed, the salt, Cs_2TlCl_5, is formed. The rubidium salt is formed when 1·5—25 grams of thallium chloride is added to a solution of 40 grams of rubidium chloride. It crystallises in thin monoclinic plates, and when recrystallised from water is converted into the salt $Rb_2TlCl_5 + H_2O$.

2 : 1-*Caesium and rubidium thallium chlorides*, $Cs_2TlCl_5,Cs_2TlCl_5 + H_2O$, and $Rb_2TlCl_5 + H_2O$.—The anhydrous caesium salt is obtained when 5—8 grams of thallium chloride is added to a somewhat concentrated solution of 100 grams of caesium chloride, the hydrated salt being obtained when dilute solutions are employed. The rubidium salt is obtained in a similar manner. The hydrated

salts are white, the anhydrous salts pale green. The caesium salt, with $1H_2O$, is easily soluble in water, but separates out anhydrous in the form of needles. The salt, $Cs_2TlCl_5 + H_2O$, crystallises in the orthorhombic system $a : b : c = 0·6762 : 1 : 0·6954$. The crystals of the rubidium salt are also orthorhombic, $a : b : c = 0·6792 : 1 : 0·7002$.

3 : 2-*Caesium thallium chloride*, $Cs_3Tl_2Cl_9$, is obtained as a heavy white precipitate on adding 5—29 grams of caesium chloride to a solution of 40 grams of thallium chloride. It crystallises in hexagonal prisms or tablets, axis $C = 0·82566$, $0001 \wedge 10\bar{1}1 = 43° 37' 50''$. The salt is stable on exposure to air, and can be recrystallised from water without change.

3 : 1-*Rubidium thallium bromide*, Rb_3TlBr_6,H_2O, is obtained by adding 1·5—24 grams thallium bromide to a very concentrated solution of 50 grams of rubidium bromide. It crystallises in beautiful golden crystals belonging to the tetragonal system: axis $C = 0·80725$; $001 \wedge 101 = 38° 54' 45''$. When recrystallised, it is converted into the 1 : 1-salt. The author was unable to obtain a 2 : 1- or a 3 : 2-rubidium salt.

3 : 2-*Caesium thallium bromide*, $Cs_3Tl_2Br_3$, crystallises in small, yellowish-red crystals, is stable in air, and can be recrystallised unchanged from water.

1 : 1-*Caesium and rubidium thallium bromides*, $CsTlBr_4$, and $RbTlBr_4 + H_2O$.—The caesium salt is obtained by adding 2—10 grams of caesium bromide to 40 grams of thallium bromide, and the rubidium salt, by adding 3—24 grams of rubidium bromide to 40 grams of thallium bromide. Both salts are pale yellow, and crystallise in the regular system. The rubidium salt crystallises from water unchanged, whereas the caesium salt is converted into the salt, $Cs_3Tl_2Br_9$.

1 : 1-*Caesium and rubidium thallium iodides*, $CsTlI_4$ and $RbTlI_4 + 2H_2O$.—Both salts are obtained from solutions containing a large excess of thallium iodide, and also of alkali iodide; they form deep-red crystals, belonging to the regular system, have a characteristic lustre which is slowly lost on exposure to air, and are decomposed by water.

3 : 1-*Sodium and lithium thallium chlorides*, $Na_3TlCl_6 + 12H_2O$ and $Li_3TlCl_6 + 8H_2O$.—The author was only able to obtain one type of double salt with these metals, and, on account of the extreme solubility of the salts, they must be prepared in very concentrated solutions. They form transparent colourless crystals which break up on exposure to air. The author was unable to prepare lithium or sodium thallium bromide.

E. C. R.

Phenomena observed in the Precipitation of Antimony from Solutions of Tartar Emetic. By J. H. LONG (*J. Amer. Chem. Soc.*, 1895, ii, 87—105).—A study in chemical dynamics. The action of sodium carbonate, sodium borate, sodium tungstate, and sodium thiosulphate on solutions of tartar emetic is described. The experiments were conducted with the object of studying the influence of mass, temperature, and time on the precipitation of the antimony.

L. DE K.

Constitution of the Platinum Bases. By PETER KLASON (*Ber.*, 1895, **28**, 1477—1489).—The author enters into an elaborate critical account of the various theories of the constitution of the platinum-ammonium compounds, and shows that the constitution of the compounds hitherto known can be expressed by the aid of structural formulæ, without having recourse to geometrical isomerism, and in fact that the geometrical theory of Werner is in part founded on imperfectly investigated reactions (see also this vol., i, 488).

A. H.

Mineralogical Chemistry.

Italian Graphites. By FAUSTO SESTINI (*Gazzetta*, 1895, **25**, i, 216—219).—With the object of ascertaining whether the natural carbons found in various parts of Italy are all graphitites, like the two specimens recently described, the author has examined a number of samples from Monte Pisano, Arbure, Monte Rosa, Calabria, Premolle, and Monte Amiati. Three of these are true graphites, containing not more than 0·87 per cent. of hygroscopic water, and not less than 57·1 per cent. of carbonaceous matter; the several graphitites examined, however, contain more than 1 per cent. of water, not more than 51·36 per cent. of carbonaceous matter, and 43·33—84·42 per cent. of mineral matter not easily decomposed by hydrofluoric acid.

W. J. P.

Genetic Relations of Rutile, Ilmenite, and Sphene. By ALFRED BERGEAT (*Jahrb. f. Min.*, 1895, i, 232—251).—It is usually supposed that sphene (including leucoxene and titanomorphite) which occurs intergrown with, and surrounding, rutile and ilmenite, has been derived from the alteration of these minerals, the ilmenite being also derived from the rutile. The author, however, describes at length occurrences of these minerals near Freiberg, which point to their all being original, having crystallised from a magma in the order, rutile, ilmenite, sphene, as is seen by the envelopes of the later formed minerals surrounding the earlier. The intergrowth of rutile and ilmenite is considered to be analogous to that of rutile and hæmatite, and several similar cases of regular intergrowth of dissimilar minerals are noticed. Analyses are given of some of these envelopes surrounding rutile: I is a greyish, opaque substance, showing under the microscope some crystals of sphene; II is a still more advanced stage in the decomposition of sphene, and shows crystals of anatase.

	SiO_2.	TiO_2.	Fe_2O_3.	CaO.	Total.
I.	45·56	46·01	3·83	2·72	99·12
II.	14·27	78·13	7·24	0·88	100·52

These analyses show that as sphene decomposes there is a gradual decrease in the amount of silica and lime, and an increase in titanium oxide, which separates as anatase (in I, free quartz was present; the iron oxide is supposed to be foreign, and due to infiltration).

L. J. S.

Artificial Dolomite. By LÉON BOURGEOIS and HERMANN TRAUBE (*Zeit. Kryst. Min.*, 1895, **24**, 519; from *Bull. soc. fran. min.*, 1892, **15**, 13).—On heating a solution of potassium cyanate containing equivalent proportions of calcium and magnesium chlorides at 130°, needles of aragonite and rhombohedral crystals were obtained, the latter having the composition, CaO 28·49, MgO 24·24.

L. J. S.

Microlite, Parisite, and Elpidite from Greenland. By GUSTAF NORDENSKJÖLD (*Jahrb. f. Min.*, 1895, i, Ref., 455—457; from *Geol. För. Förh.*, 1894, **16**, 336).—*Microlite* was found as minute, brownish-yellow octahedra on ægirine from Igaliko.

$(Ta,Nb)_2O_5$.	SiO_2.	SnO_2.	$(Fe,Al)_2O_3,(Ce,La,Di)_2O_3$.	CaO.	Loss.
54·8	13·5	3·0	12·2	9·6	6·9

After deducting the constituents required for the amount of ægirine, corresponding to 13·5 per cent. of silica, the formula is deduced as essentially $Ca_2Ta_2O_7$; very little niobium is present.

Parisite, in yellow crystals, generally consisting of the basal plane, with two acute rhombohedra of different orders, was also found on ægirine from the same locality. Analysis gave the following results.

CO_2.	$(Ce,La,Di)_2O_3$.	Fe_2O_3.	Al_2O_3.	Y_2O_3.	CaO.	K_2O.	Na_2O.	Loss.
23·0	52·1	2·2	0·7	2·5	12·2	0·7	1·5	5·1

Elpidite (see below).—The small crystals are orthorhombic and elongated in the direction of the vertical axis; the observed forms are *a*(100), *b*(010), *c*(001), *m*(110), *n*(120), *d*(011), *e*(103); $a : b : c = 0·5117 : 1 : 0·9781$.

There are also observations on Flink's new minerals, epididymite, and neptunite from the same locality.

L. J. S.

Analysis of Pyreneite. By EDUARD JANNETTAZ (*Zeit. Kryst. Min.*, 1895, **24**, 522; from *Bull. soc. fran. min.*, 1892, **15**, 127).—Crystals from Barèges gave the following results, after deducting water and carbonic anhydride.

SiO_2.	Al_2O_3.	Fe_2O_3.	MgO.	CaO.	Total.
39·4	10·0	18·6	1·0	31·2	100·2

This indicates an excess of silica, perhaps as enclosed quartz. Sp. gr. 3·7.

L. J. S.

Elpidite, a New Mineral from Greenland. By GUSTAF LINDSTRÖM (*Jahrb. f. Min.*, 1895, i, Ref., 457; from *Geol. För. Förh.*, 1894, **16**, 330).—*Elpidite* was found, together with Flink's new minerals, epididymite and neptunite (this vol., ii, 23 and 402), on ægirine from Igaliko; it is white to brick-red in colour, and fibrous, with a silky lustre. Sp. gr. varies from 2·524 to 2·594, according to the colour; easily fusible. Analysis of the mineral gave the following results.

SiO_2.	ZrO_2.	FeO.	CaO.	Na_2O.	K_2O.	H_2O (at 100° C.).
59·44	20·48	0·14	0·17	10·41	0·13	3·89

H_2O (above 100° C.).	Cl.	TiO_2.	CuO.	Total.
5·72	0·15	trace	trace	100·53

The ratio is given as $ZrO_2 : (FeCaNa_2K_2)O : H_2O : SiO_2 = 1 : 1 : 3 : 6$, it being impossible to say what parts the zirconia and water play in the formula.

L. J. S.

Neptunite. By O. A. Sjöström (*Jahrb. f. Min.*, 1895, i, Ref., 457; from *Geol. För. Förh.*, 1893, **15**, 393).—This new mineral of Flink's (this vol., ii, 23) gave the following results on analysis.

SiO_2.	TiO_2.	FeO.	MnO.	CaO.	K_2O.	Na_2O.	Total.
51·93	17·45	10·23	5·32	0·71	5·71	9·63	100·98

L. J. S.

Meteoric Iron of Verchne-Udinsk (Werchne Udinsk), Siberia. By E. A. Hugo Laspeyres and E. Kaiser (*Zeit. Kryst. Min.*, 1895, **24**, 493—494).—A piece of this meteorite weighing 2·3547 grams was slowly dissolved in cold dilute hydrochloric acid; the gases evolved indicated that only a trace of triolite was present. The insoluble residue consisted of a scaly, graphite-like substance, silicate grains (probably quartz and enstatite), and schreibersite and rhabdite; the solution contained iron, nickel, cobalt, copper, magnesium, and phosphorus. The phosphorus in the solution is calculated as iron nickel phosphide, and the composition of the meteorite is as follows.

Nickel-iron.	Fe–Ni phosphide.	Graphite.	FeS.	Slicates.
98·812	0·565	0·025	trace	0·008 = 99·410

The nickel-iron gave the following results on analysis.

Fe.	Ni.	Co.	Cu.	Mg.
91·782	7·346	0·709	0·129	0·034

The ratio $Fe : Ni + Co = 1 : 12$ agrees with that for kamacite. The very small amount of tænite, seen to be present by the etching, was dissolved by the cold dilute acid.

L. J. S.

Silicates of the Netschaëvo (Tula) Meteorite. By E. A. Hugo Laspeyres and E. Kaiser (*Zeit. Kryst. Min.*, 1895, **24**, 495—496).—The angular fragments and nests of stony matter of this iron were treated with hot hydrochloric acid; much hydrogen sulphide was evolved, and the solution contained iron, magnesium, trace of aluminium, some calcium and nickel, these corresponding with the original constituents, triolite and olivine, and a little nickel-iron and plagioclase. The gelatinous residue was seen under the microscope to consist of enstatite and, perhaps, some quartz and plagioclase. The solution of this residue in hydrofluoric acid contained much magnesium, little iron, aluminium, and calcium, and a trace of sodium; these corresponding with enstatite and, perhaps, some plagioclase.

L. J. S.

Physiological Chemistry.

Action of Thiocyanic acid on Gastric Ferments. By AUGUSTIN WRÓBLEWSKI (*Ber.*, 1895, **28**, 1719—1722).—Thiocyanic acid is without action on pepsin solutions, but, even in the proportion 1 : 50 of hydrochloric acid, it retards considerably the digestion of carmin-fibrin by pepsin. Potassium thiocyanate and ammonium thiocyanate behave like the free acid. The coagulation of milk by means of rennin is considerably retarded by the presence of potassium thiocyanate; neither result is due to any specific action on the ferment, but in the former case the thiocyanate coagulates the carmin-fibrin and so withdraws it to a great extent from the action of the pepsin; in the latter, a double decomposition probably occurs, and the caseïn dissolves. The experiments are fully tabulated. J. B. T.

Action of the Mucous Membrane of the Stomach and Intestine on some Bioses and on Raffinose. By WALTHER PAUTZ and J. VOGEL (*Zeit. Biol.*, 1895, **32**, 304—307).—The hydrolytic action of the mucous membrane of the small intestine on maltose has been shown by several previous observers. In the present experiments, the gastric mucous membrane of dogs and new-born children was employed, as well as the intestinal, the sugars investigated being isomaltose, lactose, and raffinose. At the end of 18, and again at the end of 36 hours, the sugar was investigated by the polarimeter, phenylhydrazine test, &c. The stomach, ileum, and large intestine only effected a partial inversion of maltose and isomaltose, but the jejunum had turned them completely into dextrose. The stomach, ileum, and large intestine had no effect on lactose; but the jejunum effected a partial change into dextrose. In the last case, besides dextrosazone, an osazone melting at 142° was also obtained.

W. D. H.

Comparison of the Ferment Actions of Saliva, Pancreatic Juice, Intestinal Juice, and Blood on Starch. By CARL HAMBURGER (*Pflüger's Archiv.*, 1895, **60**, 543—577).—A comparison of the action of the above-mentioned liquids on starch shows differences in two directions. The maximum of reducing action shown in the same time (24 hours) is different, and this maximum is reached more rapidly in some cases than others. The maximum of reduction for saliva is 0·31; for pancreatic juice, 0·36; for intestinal juice, 0·26; and for blood, 0·8, the reducing power of dextrose being taken as 1. In the case of saliva, this is reached within an hour, in that of blood after 24 hours; pancreatic juice is quicker than saliva, and intestinal juice slower than blood. Saliva thus acts rapidly, but the reducing value of the product is low; blood acts slowly, but the reducing value of the product is very high, the difference of reducing value depending on the different forms of sugar produced. With saliva, the sugar yields, on suitable treatment, after the dextrins have disappeared, maltosazone and isomaltosazone, but very little glucosazone. In the case of blood, much glucosazone is obtained (compare Bial). Probably two ferments are to be reckoned with, diastase, which transforms starch into dextrins and maltose, and glucase, which transforms it into glucose, perhaps through a maltose stage. The latter ferment is specially abundant in blood; saliva contains more diastase than blood or intestinal juice. Pancreatic juice is even richer in this ferment. But glucase is nearly absent in saliva, though fairly abundant in pancreatic juice. Intestinal juice, on the other hand, contains still less diastase than blood, more glucase than saliva, but less than the blood and pancreatic juice. W. D. H.

Digestibility of Pentosans. By LINDSEY and HOLLAND (*Bied. Centr.*, 1895, **24**, 311—312; from *Agric. Science*, 1894, **8**, 172—183).—Pentosans which yield xylose occur frequently in agricultural plants, whilst those which yield arabinose are found in the sap of many plants. In experiments with rabbits fed with maize-meal and bran, Stone found about 60 per cent. of the pentosans were digested; similar results were obtained with sheep fed with hay.

Experiments made with hay, brewers' grains, linseed meal, wheat bran, &c., showed that in six cases out of nine, the pentosans were just as digestible as the other food constituents. In foods such as hay and grains in which lignin predominates, the pentosans are less digestible than in the concentrated foods.

The question still remains whether the pentosans are assimilated and have a real value. N. H. J. M.

Relation of Fat and Carbohydrates to the Decomposition of Albumin in the Human Body. By R. KAYSER (*Bied. Centr.*, 1895, **24**, 344; from *Diss. Berlin*, 1893).—Experiments made by the author on himself, showed that fat was much less able to maintain the albumin equilibrium in the body than isodynamic amounts of carbohydrates.

To maintain nitrogen equilibrium with proteïds and fat alone, a very great amount of potential energy is necessary, far in excess of the total requirements; whilst deposition of albumin seems to be excluded under these conditions.

The experiments lasted only a very short time, and it is not known, therefore, whether the conclusions would hold for longer periods. In the meantime, the advisability of employing a pure meat fat diet for diabetes must be considered questionable. N. H. J. M.

Does Inulin lead to the Formation of Glycogen in Vegetable Feeders? By K. MIURA (*Zeit. Biol.*, 1895, **32**, 255—265).—The experiments made on rabbits show that after six days inanition, the taking of inulin often leads to the formation of small quantities of hepatic glycogen, especially when the dose is large. Levulose is found in the intestine in most cases. The change into levulose is slow and not complete; the inconstancy of the result on the hepatic glycogen is probably due to this circumstance. W. D. H.

The Inversion of Cane Sugar in the Small Intestine. By K. MIURA (*Zeit. Biol.*, 1895, **32**, 266—278).—The invertin of the small intestine does not depend on the introduction of food, for it is found in those born dead. It is also independent of bacterial action, for the intestine of those just born is free from micro-organisms. Stomach, colon, and pancreas have an exceedingly weak inverting action. W. D. H.

Exchange of Blood-gases in Brain and Muscle. By LEONARD HILL and D. N. NABARRO (*J. Physiol.*, 1895, **18**, 218—229).—A full account of experiments, a preliminary notice of which has already appeared (this vol., ii, 231). The small increase of gas exchange in the brain during activity entirely negatives Mosso's statement that the brain is a tissue where only active metabolism occurs.

W. D. H.

Grape Sugar in Blood. By K. MIURA (*Zeit. Biol.*, 1895, **32**, 279—280).—In ox blood, the sugar present is dextrose, identified by its osazone. W. D. H.

Physiological Action of Extract of Suprarenal Capsule. By EDWARD A. SCHÄFER and GEORGE OLIVER (*J. Physiol.*, 1895, **18**, 230—276).—A full account with numerous illustrative tracings of experiments already described in a preliminary notice (this vol., ii, 235). W. D. H.

Physiological Action of Extracts of Pituitary Body. By EDWARD A. SCHÄFER and GEORGE OLIVER (*J. Physiol.*, 1895, **18**, 277—279).—Extract of pituitary body raises, of thyroid lowers, of spleen first lowers, then raises, the blood pressure. In the first case, the very marked rise is due to increase of the heart's force, and contraction of the anterioles. The opposite action of thyroid and pituitary extracts negatives the idea that the two glands are vicarious in function. W. D. H.

Heat Production in Glands. By E. WAYMOUTH REID (*Proc. physiol. Soc.*, 1895, 31—33).—The production of heat in secreting glands when stimulated to activity by excitation of nerves cannot be demonstrated by any apparatus at present devised for detecting small changes in temperature. (Compare Bayliss and Hill, Abstr., 1894, ii, 358.) W. D. H.

Gases of Human Milk. By EDUARD KÜLZ (*Zeit. Biol.*, 1895, **32**, 180—184).—In five researches, 100 c.c. of human milk yielded 1·07 to 1·44 c.c. of oxygen, 2·35 to 2·87 c.c. of carbonic anhydride, and 3·37 to 3·81 c.c. of nitrogen. The method of collecting the milk could not have obviated admixture with minimal quantities of air; hence, perhaps, the higher percentage of oxygen and nitrogen than previous observers have found in the milk of lower animals.

W. D. H.

Paralactic acid in Normal Pericardial Fluid. By C. KÜLZ (*Zeit. Biol.*, 1895, **32**, 252—254).—The normal pericardial fluid of the ox contains paralactic acid, identified by polarimetric observation and by analysis of its zinc salt. W. D. H.

Metabolism in Diabetes. By WALTHER PAUTZ (*Zeit. Biol.*, 1895, **32**, 197—251).—The research was carried out by analysing the food taken, and the excreta, urine, and fæces. As many as 24 diabetic patients were investigated; the results in each case are given in full. In none of these cases was there any increase of metabolism, so far as proteïd and fat are concerned; indeed, in 11 cases it was lessened, but the differences are small, and differences as great are found in healthy people, similar observations on four of whom served as control experiments. W. D. H.

Alimentary Glycosuria. By K. MIURA (*Zeit. Biol.*, 1895, **32**, 281—303).—Experiments were made on a boy, a man, and dogs, by administering large amounts of different kinds of carbohydrate, and examining the urine by the polarimeter, and by Fehling's, the fermentation, and the phenylhydrazine tests. Starch, even in very large doses, does not lead to glycosuria. Dextrose does pass into the urine; thus, after a dose of 345 grams, 0·7 gram was found in the urine. Lævulose is not borne well, causing sickness and diarrhœa in large doses; from 0·6 to 2·7 per cent. passed as such into the urine. Maltose in man caused no glycosuria; in dogs, 2·8 per cent. passed into the urine as such; but when given as beer-wort, a small quantity of dextrose was found. 1·08 per cent. of cane sugar passed as such into the urine, but in dogs a larger quantity was found together with invert sugar. In both dogs and men, milk sugar passed as such into the urine, to the extent of 2 to 4 per cent. In some cases, several of the sugars were found in small quantities in the saliva as well as the urine.
W. D. H.

Pentoses in Diabetic Urine. By EDUARD KÜLZ and J. VOGEL (*Zeit. Biol.*, 1895, **32**, 185—196).—Tollen's reaction for pentoses failed in 64 specimens of human diabetic urine, was doubtful in 12, and positive in 4 only. But in diabetes of the severe form produced in dogs by extirpation of the pancreas, or administration of phloridzin, the reaction is given well. Pentose was identified by its osazone, which was separated from glucosazone by its solubilities, but the pentose differs from those hitherto described in being fermentable with yeast. Its osazone melts at 150—158°, the melting point varying slightly in the different cases, which are described in full; analyses of the osazone agrees very well with the formula $C_{17}H_{20}N_4O_3$. W. D. H.

Apparent Presence of Sugar in the Urine of Persons taking Sulphonal. By PH. LAFON (*Compt. rend.*, 1895, **120**, 933).—The urine of a person who was taking 0·75 to 1·0 gram of sulphonal per day gave a distinct reduction with Fehling's solution, although, instead of the dextrorotatory power characteristic of diabetic sugar, it showed a very slight lævorotation. The addition of 1 gram of sulphonal per litre to urine quite free from sugar gives precisely the same reduction of Fehling's solution. C. H. B.

Amount of Iron in Urine. By LOUIS LAPICQUE (*Bull. Soc. Chim.*, 1895, [3], **13**, 281—285).—To estimate iron in urine, a sufficient quantity (200—300 c.c.) is evaporated to dryness with a small amount of nitric acid, and the residue incinerated; the ash is then extracted with hydrochloric acid, and the iron precipitated as phosphate in acetic acid solution, the phosphates of the alkaline earths being thus eliminated. The phosphate of iron is then dissolved in nitrosulphuric acid, and the iron estimated colorimetrically with thiocyanate. The test analyses quoted are satisfactory. Examination of various urines, both healthy and pathological, by this process showed the presence of traces only of iron; the sole exception was that of the urine of a healthy man, which contained 0·6 milligram per litre. JN. W.

Acetonuria. By ERNST BECKER and EMILIO PARLATO (*Virchow's Archiv*, 1895, **140**, 1—22).—In healthy men, after narcosis, acetonuria is a frequent symptom. It lasts from a few hours to several days; this was very marked in a case of bromether intoxication. It is evidence of increased proteïd metabolism.

The estimation of the acetone was effected as follows. 200 c.c. of urine was treated in a flask with 1 c.c. of phosphoric acid and distilled, a stream of air passing the while over the liquid at the end of the distillation. The distillate, after treatment with powdered calcium oxide to remove carbonic anhydride, was brought directly into the flask of Geissler's vaporimeter, the tension was estimated, and the percentage of acetone thus calculated for the original quantity of urine. W. D. H.

Physiological Action of Carbonic Oxide. By JOHN S. HALDANE (*J. Physiol.*, 1895, **18**, 201—217).—The poisonous action of carbonic oxide diminishes as the oxygen tension increases, and *vice versâ;* at a tension of 2 atmos. of oxygen, the poisonous action is abolished in the case of mice. The disappearance of the poisonous action is due to the fact that at high oxygen tensions the animals can dispense entirely with the oxygen-carrying function of hæmoglobin, the oxygen being contained in the plasma. The poisonous action of carbonic oxide is entirely due to its power of combining with the hæmoglobin of the red corpuscles, and so putting them out of action as oxygen carriers. W. D. H.

Toxicological Properties of Hydroxylamine. By ADALBERTO PASQUALI (*Chem. Centr.*, 1894, ii, 957—958; from *Boll. Chim. Farm.*, 1894, 19).—See this vol., ii, 413.

Chemistry of Vegetable Physiology and Agriculture.

The Glucosazone from Sumach and from Vallonia. By CARL BOETTINGER (*Arch. Pharm.*, 1895, **233**, 125—127; compare Abstr., 1891, 70).—The author finds that the osazones of the sugars obtained from Sumach and from Vallonia are identical, and that they agree in all their properties with the osazone obtained from grape sugar. By warming a mixture of glucose and glyoxylic acid, the author has obtained a condensation product of the acetal type, this is being subjected to further examination. J. J. S.

A Crystalline Constituent of Basanacantha Spinosa, Var. Ferox, Schum. By BRUNO GRÜTZNER (*Arch. Pharm.*, 1895, **233**, 1—5).—By treating the leaves and bark of *Basanacantha Spinosa*, *var. ferox*, *Schum.* with alcohol, the author has succeeded in extracting about 2 per cent. of mannitol; the alcoholic solution was evaporated, the residue extracted with water, and the solution precipitated with lead acetate. The filtrate, after the lead had been removed by means of hydrogen sulphide, was evaporated to a syrup, which, when cold, set to a mass of crystals of mannitol.

The author cannot confirm Kwasnik's statement (Abstr., 1892, 1509) that pure mannitol reduces Fehling's solution slightly after boiling or long standing. It does, however, give a silver mirror with ammoniacal silver nitrate. J. J. S.

The Occurrence of Hesperidin in Folia Bucco. By P. ZENETTI (*Arch. Pharm.*, 1895, **233**, 104—111).—The author finds that there is a considerable quantity of hesperidin in the dried leaves of *Diosma alba* and of *Folia bucco.* When the dried leaves are placed in any liquid, the outer epidermal layer becomes separated from the inner, and the space thus formed between the two layers is seen to be filled with yellowish-brown crystals of hesperidin of various shapes.

J. J. S.

Presence of Chitin in the Cellular Membrane of Mushrooms. By EUGÈNE GILSON (*Compt. rend.*, 1895, **120**, 1000—1002).—When mushrooms (*Agaricus campestris*) are treated successively with dilute sodium hydroxide solution, boiling dilute sulphuric acid, alcohol, and ether, a white substance is left, which, when dried, becomes hard and compact and acquires a horny appearance and structure; its composition is C, 46·11; H, 6·98; N, 6·17; which agrees very closely with the analyses of chitin by Schmidt, Stadeler, Lehman, and Ledderhose, and the substance has all the properties of chitin. It is insoluble in all solvents except concentrated acids, and, when treated with hot concentrated hydrochloric acid, it yields crystals of glucosamine hydrochloride. When heated with potassium hydroxide at 180°, it yields mycosin.

The same substance is obtained from *Amanita muscaria*, *Cantharellus cebarius*, *Hypholoma fasciculare*, *Polyporus officinalis*, *Polyporus fumosus*, *Russula*, *Boletus*, *Tricholona*, *Bovista*, and *Claviceps purpurea.*

It would seem that chitin plays the same part in mushrooms as cellulose does in all the phanerogams and many of the cryptogams, and constitutes the chief part of the cellular membrane, in which it is associated, however, with carbohydrates analogous to or identical with those found in phanerogams. C. H. B.

Glyoxylic acid in Green Fruits. By HEINRICH BRUNNER and ERNEST CHUARD (*Bull. Soc. Chim.*, 1895, [3], **13**, 126—128).—Replying to Ordonneau (Abstr., 1892, 589), the authors cannot accept his view that the glyoxylic acid which they isolated, and the glycollic acid which Erlenmeyer isolated from various plants, were none other than his tartromalic acid. In the first place, Ordonneau dealt only with grapes, and with wine residues, whilst the authors examined other fruits, as well as the leaves and buds of plants; and, in the second place, Ordonneau's acid is not capable of reducing ammoniacal silver solutions in the cold, as was, in every case, the acid isolated by the authors, which, therefore, could be none other than glyoxylic acid.

The view that the carbonic acid undergoes gradual reduction during the growth of the fruit is confirmed by the isolation of glyoxylic and glycollic acids from the unripe fruit, as the successive products must be formic, oxalic, glyoxylic, glycollic, succinic, and malic acids, &c. According to this view, also, the glyoxylic acid should gradually disappear as the plant ripens, and this has been proved to be the case. JN. W.

Mid-European Nut Galls and Scrophularia Nodosa L. By F. KOCH (*Arch. Pharm.*, 1895, **233**, 48—99).—Fresh nut galls, gathered in the beginning of the autumn, 1893, were subjected to examination, with the following results.

Moisture	85·71 per cent.
Vegetable tissue...........	11·39 ,,
Nitrogen	0·21 ,,
Ash	0·197 ,,

The ash had the following composition.

SiO_2	17·79 per cent.
P_2O_5	32·38 ,,
CaO	5·17 ,,
SO_3.......................	24·82 ,,
H_2O	15·65 ,,

The sugar and tannin were estimated in two different lots of galls: (1) ripe galls, gathered in January; (2) unripe galls, gathered in September. The percentages given refer to the dried, and not to the fresh, moist galls.

	(1).	(2).
Sugar......	51·81 per cent.	21·47 per cent.
Tannin.....	14·85 ,,	16·87 ,,

The galls were finally extracted with (1) petroleum ether, (2) ether, (3) alcohol, and (4) water, in the order given. From the combined petroleum and ethereal extracts, a white substance was obtained, which the author terms *gallocerin*, as it very much resembles the cerin of John, of Chevreul, and of Wittstein. After recrystallisation from alcohol, it forms feathery clusters of crystals, which melt at 173°. It apparently has the composition $C_{19}H_{31}O_2$ or $C_{20}H_{36}O_2$, and is remarkably indifferent towards most reagents, it yields an amorphous monobromo-derivative, however, when treated with bromine, and is decomposed into a mixture of two acids when boiled with potash.

The alcoholic extract yielded tannin and gallic acid, together with a mixture of sugars, from which dextrose was isolated in the pure form; but no characteristic substance could be isolated from the aqueous extract.

Scrophularia nodosa.—The ash from the roots contains potassium, sodium, calcium, magnesium, iron, manganese, chlorine, phosphoric acid, and silica.

The ethereal extract yielded butyric and cinnamic acid, together with lecithin; the latter was identified by its decomposition into choline, phosphoric, palmitic, and oleic acids.

From the alcoholic extract, the author has obtained: (1) A resin, which, when hydrolysed, yielded cinnamic acid. (2) Caffetannic acid (compare Hlasiwetz, *Annalen*, **142**, 220; Kunz-Krause, Abstr., 1893, ii, 327), which, when hydrolysed, gave dihydroxycinnamic acid and a sugar, apparently dextrose. (3) A sugar which could not be obtained in the crystalline form, but which seems to be dextrose. (4) Choline. The author states that the scrophularin of Walz (*Jahresber. Fortsch. Chem.*, 1853, 567) does not exist, that Walz's scrophularosamine is palmitic acid, and his scrophularacrin is cinnamic acid. No characteristic compounds could be obtained from the aqueous extract, but the author states that dulcite is not present (compare Eichler).

J. J. S.

Effect of Arsenic on Vegetation. By Aug. Lyttkens (*Bied. Centr.*, 1895, **24**, 352; from *Kgl. landtbruksakad. handl. o. tidskr.*, 1894, **33**, 317—320).—Experiments in which barley was grown in garden soil, and in the same soil to which 0·005 and 0·01 per cent. of arsenious acid (as potassium salt) was added, showed that those quantities of arsenic caused slow and feeble growth, and a blue-green colour.

An examination of 75 samples of superphosphates received at Halmstad showed 40 per cent. to be strongly arsenical (As_2O_3 = about 0·1 per cent.), 15 per cent. slightly arsenical, and the rest free from arsenic. The strongly arsenical samples of known origin were foreign.

N. H. J. M.

Analytical Chemistry.

Sources of Error in Alkalimetry. By P. Dobriner (*Zeit. angw. Chem.*, 1895, 259—262).—The author states that if a sample of any acid is titrated with standard soda under exactly the same conditions as when doing the check experiment, no sources of error are introduced by the presence of a small quantity of carbonate in the alkali.

L. de K

Luteol, a new Indicator. By WILHELM AUTENRIETH (*Arch. Pharm.*, 1895, **233**, 43—48).—See this vol., i, 572.

Modification of Soxhlet's Extraction Apparatus. By A. PHILIPS (*Ber.*, 1895, **28**, 1475). The side tube of the ordinary Soxhlet, which conveys the vapour of the liquid to the condenser, is replaced by an annular space which surrounds the extraction space into which the liquid drops after condensation. This acts as a vapour jacket, and keeps the extracting liquid at a temperature near its boiling point throughout the extraction, a considerable amount of time being thus saved. A. H.

Estimation of Halogens by Carius' Method: Application of Volhard's Modification. By FRITZ W. KÜSTER (*Annalen*, 1895, **285**, 340—348).—The author describes in detail the conditions under which halogen determinations are carried out in the Marburg laboratory. By enveloping the tube in blotting paper, risk of explosion is minimised, and the temperature may be raised as rapidly as possible to 320—340°, at which most substances are completely decomposed after an exposure of two hours. On diluting the contents of the tube with water, it suffices, when chlorine is being estimated, to allow the liquid to remain for a short time on the water bath, but in the case of bromine and iodine more systematic treatment with boiling water is necessary; the silver haloïd is then transferred to a Gooch crucible, which is dried for $1\frac{1}{2}$ hour in the vapour of boiling xylene.

In Volhard's modification of Carius' method, a known quantity of silver nitrate is employed, and after removing the silver haloïd, the excess of silver is determined by titration with ammonium thiocyanate. The author, in applying this modification, has found it untrustworthy, titration invariably indicating the presence of silver in too small a quantity. Careful quantitative experiments have traced this discrepancy to the familiar brown stain acquired by tubes employed in halogen determinations, the coloration being due to silver, which is taken up by the glass in quantities which increase with the temperature and duration of heating. M. O. F.

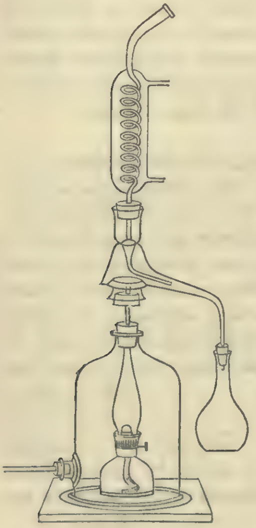
Estimation of Sulphur in Pyrites. By THOMAS S. GLADDING (*J. Amer. Chem. Soc.*, 1895, **17**, 397—401).—A reply to Lunge (this vol., ii, 291), stating that the author's modifications of his process are absolutely necessary to get accurate results. L. DE K.

Estimation of Sulphur in Iron and Steel. By LOUIS CAMPREDON (*Compt. rend.*, 1895, **120**, 1051—1054).—2·5 to 10·0 grams of the metal is dissolved in 100 c.c. of sulphuric acid (1 : 5) or hydrochloric acid (1 : 3) in a flask previously filled with carbonic anhydride, and connected with two apparatus supplying hydrogen and carbonic anhydride respectively. The mixture of gas evolved by the action of the acid on the metal, with the hydrogen and the carbonic anhydride, is passed through a porcelain tube heated to orange redness or an incipient white heat, and all the gaseous sulphur compounds are thus converted into hydrogen sulphide. The gas is then passed into 100 c.c. of a slightly acidified solution of zinc acetate, and the zinc sulphide that is precipitated is mixed with standard iodine solution, the excess of the latter being ascertained by means of standard sodium thiosulphate solution.

The zinc acetate solution is prepared by dissolving 10 grams of zinc oxide in 25 c.c. of glacial acetic acid, diluting to about 500 c.c., adding sufficient ammonia to redissolve the precipitate which forms at first, and then slightly acidifying with acetic acid.

To prepare the iodine solution, 7·9 grams of purified iodine, together with 25 grams of potassium iodide, is dissolved in 1000 c.c. of water, 1 c.c. = 0·001 gram of sulphur. The thiosulphate solution contains 10 grams of sodium thiosulphate and 2 grams of ammonium carbonate per litre. C. H. B.

Estimation of Sulphur in Petroleum. By Friedrich Heusler (*Zeit. angw. Chem.*, 1895, 285—286).—The apparatus (see illustration) consists of four parts: a small petroleum lamp with its chimney, a reflux condenser, and a special connecting piece which causes the condensed liquid to run into a receiver by means of a small funnel. The wide top end of the coiled cooling tube is closed by a doubly-perforated stopper; through one opening passes a tube connected with a suitable aspirator; through the other one is introduced a capillary angular syphon through which drops a solution of potassium permanganate. This solution first runs over a pad of glass wool contained in the wide upper tube. If the sample is somewhat rich in sulphur, the permanganate will sometimes be rapidly decolorised; in this case it probably does not run in quickly enough.



To carry out an experiment, the lamp (without its glass) is taken out, filled with about 20—30 grams of the sample, and weighed. Then the suction pump and the capillary syphon are put in action, and when the permanganate solution has moistened the whole of the coil, the condenser and connecting piece are lifted up, and the lighted lamp is fixed to the lamp-glass, which is attached to the top of the bell-jar by means of a perforated cork. The bell-jar is put on to a greased glass plate, the cooler and connecting piece are lowered, and the latter is connected by a glass tube and cork with the jar. With a little practice, it will be found easy to so regulate the force of the air current that complete combustion takes place; once set going satisfactorily, the lamp will burn 12 hours, or even longer. The lamp is then re-weighed, the loss in weight representing the amount of oil burned. The condenser, connecting piece, and lamp-glass are all rinsed with water, and the washings added to the liquid in the receiver, which should still contain excess of permanganate. After boiling with hydrochloric acid and filtering, barium chloride is added.

L. DE K.

Standardising Sulphuric acid. By F. S. SHIVER (*J. Amer. Chem. Soc.*, 1895, **17**, 351—354).—Weinig (Abstr., 1892, ii, 145) has recommended standardising sulphuric acid by neutralising it with ammonia, evaporating to dryness, and finally weighing the ammonium sulphate.

The author states that excellent results may be obtained by this process, but as some ammonia is liberated during the evaporation, it is advisable to moisten the dry residue with ammonia of 0·96 sp. gr., and to again evaporate to dryness. Before weighing, the ammonium sulphate is dried at 110—120°. L. DE K.

Assay of Fuming Sulphuric acid. By GEORG LUNGE (*Zeit. angw. Chem.*, 1895, 221—222).—The total acidity of fuming sulphuric acid is generally estimated by means of standard soda, from which is then deducted the acidity due to the sulphurous acid, which is estimated as usual with standard iodine. This process may, however, lead to grave errors.

The indicator used is not a matter of indifference; phenolphthaleïn is not to be recommended, as the soda nearly always contains carbonate, and litmus is out of the question on account of the sulphurous acid. The only good indicator is methyl-orange, but it must be remembered that when using this reagent, neutrality is reached, not when the whole of the sulphurous acid is converted into the neutral sulphite, but as soon as the acid sulphite is formed.

L. DE K.

Chemical and Toxicological Properties of Hydroxylamine. By ADALBERTO PASQUALI (*Chem. Centr.*, 1894, ii, 957—958; from *Boll. Chem. Farm.*, 1894, 19).—Angeli's test for hydroxylamine with sodium hydroxide and nitroprusside is well known. Another delicate test is to boil the solution of hydroxylamine hydrochloride with copper sulphate, when nitrous oxide is evolved and cuprous chloride precipitated. Lead peroxide is changed into lead hydroxide, or lead chloride or sulphate also accompanied by evolution of nitrous oxide, whilst the solution contains lead nitrate and nitrite. Magnesium in contact with solutions of hydroxylamine liberates hydrogen. Aqueous potash and carbon bisulphide first give a yellow, and then an orange, liquid; basic lead acetate, or lead hydroxide substituted for the potash, give, on warming, a canary-yellow colour, which fades on adding acids, but turns black with potash. As hydroxylamine does not affect the usual indicators, its salts may be titrated best in presence of phenolphthaleïn with standard alkali. A new volumetric process is based on the fact that hydroxylamine decolorises an ammoniacal solution of copper sulphate.

As regards its poisonous character, the author found that it only acts in large doses: 7·75 grams of the hydrochloride given to a dog in small portions during nine days did not affect the animal, but 3 grams administered all at once, caused death. There is no difficulty in finding traces of the poison in bodies after death even after the lapse of a month.

When hydroxylamine poisoning is suspected, the urine should be tested for nitrous acid. L. DE K.

Volumetric Estimation of Phosphorus in Steel and Cast Iron. By WILLIAM A. NOYES and J. S. ROYSE (*J. Amer. Chem. Soc.*, 1895, 129—137).—Two grams of the sample is put into a 500 c.c. flask, 50 c.c. of nitric acid added, and heat applied until solution is complete; 10 c.c. of a 1·25 per cent. solution of potassium permanganate is then poured in, and the boiling continued until the pink colour disappears. Ferrous sulphate is added, with shaking, until the liquid clears, and, after cooling to 50°, 8 c.c. of ammonia of 0·9 sp. gr. is added, the stopper inserted, and the precipitate redissolved by shaking. The solution is then heated as many degrees above or below 60° as the molybdate solution (100 grams of molybdic acid, 400 c.c. of ammonia, 1000 c.c. of nitric acid, sp. gr. 1·2) is below or above 27°; 60 c.c. of this solution is added, the stopper is inserted, and the whole shaken, best with a machine, for five minutes. After another five minutes, the molybdate precipitate is collected on a filter of fine texture, and washed with solution of hydrogen ammonium sulphate (27·5 c.c. of ammonia of 0·96, 24 c.c. of sulphuric acid, and 500 c.c. of water) until the washings are no longer coloured by hydrogen sulphide. The precipitate is now dissolved in 12 c.c. of ammonia of sp. gr. 0·96, the filter is washed with 100 c.c. of water, 80 c.c. more water is added, and then 10 c.c. of sulphuric acid.

The solution is passed through a Jones' reductor containing zinc, no air being allowed to pass through during reduction or the washing, and the filtrate is at once titrated with permanganate. The phosphorus equivalent is found by multiplying the iron equivalent of the permanganate by 0·01538. L. DE K.

Estimation of Phosphoric acid by means of Ammonium Molybdate. By HANNS VON JÜPTNER (*Chem. Centr.*, 1894, ii, 813—814; from *Österr. Zeit. Berg. Hütt.*, **42**, 471—473).—The author has found that tartaric acid even in large excess does not prevent the complete precipitation of phosphoric acid by molybdate solution. The addition of tartaric acid to the molybdate solution or to the phosphate is therefore to be recommended to prevent the contamination of the yellow precipitate with ferric compounds.

L. DE K.

Estimation of Phosphoric acid by the Molybdic acid-Magnesia Process. By RUDOLF DE ROODE (*J. Amer. Chem. Soc.*, 1895, 43—46).—The author has proved that at 65° the precipitation of phosphoric acid by the ordinary molybdate solution is complete in five minutes. In analysing phosphates, the author has found it advantageous to add a definite quantity of sodium phosphate solution, the results then being more accurate. The weight of magnesium pyrophosphate yielded by this solution is, of course, deducted from the actual weight. Or, the ignited magnesia precipitate is dissolved in nitric acid and reprecipitated with molybdate solution, and finally with magnesia mixture; in this case, there is no need for adding sodium phosphate. The author also recommends working on fairly large quantities of substance. L. DE K.

Estimation of Phosphoric acid. By H. PEMBERTON (*J. Amer. Chem. Soc.*, 1895, 178—181).—The molybdate solution should be added slowly so as to get the yellow precipitate in a crystalline and consequently purer condition. The precipitate is best treated according to the volumetric method, which is quite as trustworthy as the gravimetric process. If titrated with standard alkali, the indicator should be phenolphthaleïn, not methyl-orange. L. DE K.

Preparation of Thioacetic acid and its Use in Toxicology. By N. TARUGI (*Gazzetta*, 1895, **25**, i, 269—273; compare Schiff and Tarugi, this vol., ii, 84).—The best method of preparing thioacetic acid for analytical purposes is a slight modification of that described by Kekulé and Linnemann (*Annalen*, **123**, 278), which consists in cautiously distilling phosphorus pentasulphide (300 grams) with glacial acetic acid (108 grams) over a naked flame from a 2-litre flask, pellets of glass (100 grams) being added to prevent frothing; the thioacetic acid may be collected until the thermometer registers 100°, and after one redistillation—collecting the fraction boiling at 90—95°—is perfectly free from arsenic, and may be at once used in toxicological investigation for the precipitation of arsenic. The acid is dissolved in water (2 parts) with the aid of a little ammonia, and the solution thus obtained is boiled with the arsenical liquid; the arsenic is immediately deposited as sulphide, which is collected and examined in Marsh's apparatus. W. J. P.

Separation of Arsenic from other Elements by means of Methylic Alcohol and Hydrogen Chloride. By CARL FRIEDHEIM and PAUL MICHAELIS (*Ber.*, 1895, **28**, 1414—1422).—The authors recommend the use of methylic alcohol instead of ferrous chloride in E. Fischer's method for the estimation of arsenic (Abstr., 1881, 195). The general method of procedure is as follows:—

A distilling flask of about 250 c.c. capacity is used, and is fitted with a ground head which is fused to the condenser; a small separating funnel is also ground into the head, and reaches to the bottom of the flask. The receivers are also united to the condenser by means of ground joints. The solution of the substance to be analysed is placed in the flask, and 50 c.c. of methylic alcohol is added; 20 c.c. of concentrated nitric acid is poured into the first receiver, and the others are moistened with distilled water. The mixture in the flask is then saturated with dry hydrogen chloride, the separating funnel serving to keep the methylic alcohol from running back into the drying bottle; during the operation, the flask is kept cool by means of cold water, and, after the solution is completely saturated with hydrogen chloride, it is heated on the water bath while a slow stream of the gas is kept passing through the liquid. If much arsenic is present the operation must be repeated two or three times. Fresh methylic alcohol is added by means of the separating funnel, and the saturation and distillation are repeated. The distillate, after all the arsenic has passed over, is poured into a porcelain dish and diluted with water; 20—30 c.c. of concentrated nitric acid is added, and, after the vigorous evolution of chlorine has ceased, the whole is evaporated down on the water bath to about 100 c.c. Another 20—30 c.c. of concentrated nitric acid is added, and the liquid is then evaporated down to dryness; the residue is extracted with water, filtered, and precipitated with magnesia mixture. Details are given (1) of estimations of pure arsenic; (2) of the separation of arsenic and vanadic acid; (3) of the separation of arsenic and molybdic acid; (4) of the estimation of arsenic and tungstic acid.

In order to completely separate arsenic and vanadic acid, it is necessary to reduce the latter to V_2O_4, by warming for a short time with sulphurous acid, and then to distil in the usual way, as otherwise part of the vanadium passes over with the arsenic.

In order to prevent part of the molybdenum from passing over with the arsenic, it is necessary to dilute the methylic alcohol with water for the first operation. Arsenic acid in the presence of tungstic acid cannot be estimated by this method, as 2—3 per cent. of the arsenic always remain behind in the distilling flask. The author recommends the estimation of the two together by means of mercurous nitrate solution (see Gibbs, *Proc. Amer. Academy*, **16**, 134), then the estimation of the tungsten separately, and the calculation of the arsenic from the difference. J. J. S.

Two New Colorimeters for Carbon Estimation. By WALTER G. MCMILLAN (*Chem. Centr.*, 1895, i, 173—174; from *Stahl u. Eisen*, 1894, 1073—1075).—The first apparatus consists of two graduated cylinders, one of these containing the solution to be tested, and the other the standard solution used for comparison; the second cylinder being connected by a side tube with a reservoir containing a float. By depressing the latter, the depth of the column of liquid in the comparison tube can be adjusted so as to correspond in colour with the solution which is being tested. A milk-white stopper is placed level with the zero in each tube, and a movable shutter facilitates the reading of the graduation. In the second form of apparatus, the standard liquid and that for comparison are placed in tubes the upper part of which is expanded in the form of a basin. These are enclosed in a blackened case with a long slit in the bottom, to which light is directed by a reflector, and in each, another tube is made to slide and regulate the depth of liquid. The sliding tubes are provided with an index working on a scale, and to begin with are depressed till the liquid is forced into the basin-like neck of the containing tubes, and a white disc only appears on observation. This is taken as zero. One tube is then raised until a suitable colour and depth of liquid is obtained, and the other is adjusted to correspond. L. DE K.

Analysis of Bone-black. By W. D. HORNE (*J. Amer. Chem. Soc.*, 1895, ii, 51—55).—The author restricts the analysis to the estimation of moisture, carbon, calcium carbonate, sulphate, and sulphide, also iron and alumina. The analytical details present, on the whole, no novel features. The density is determined by filling a weighed 100 c.c. flask, with sloping sides, with the sample and re-weighing; this gives the sp. gr. of the loose char. The flask is then gently tapped, and more char is added; this gives the sp. gr. of the packed sample.

To determine the relative durability of sample under continued friction, the following test is recommended: 25 grams of the sample between 16—24 grist is thrown on a sieve with circular holes one-fiftieth of an inch in diameter, the sieve shaken backwards and forwards 10 times, tapped three times, and the shaking and tapping repeated twice. This drives the dust through, and it is weighed. Dust and char are then both put into a cylinder of tinned iron, 4 inches in diameter and 2 inches deep, along with six glazed porcelain marbles, five-sixths of an inch in diameter, and jointly weighing 74·66 grams. The can is now shaken backwards and forwards with a slightly rotatory motion 200 times, the marbles are removed, and the char is again sifted. The increase in the weight of dust will then give an idea as to the quality of the sample. L. DE K.

Absorption Apparatus for Elementary Analysis. By JULIUS BREDT and WILHELM POSTH (*Annalen*, 1895, **285**, 385—386).—The authors advocate the employment of soda-lime as a substitute for potassium hydroxide. M. O. F.

Estimation of Potash in Kainite. By RUDOLF DE ROODE (*J. Amer. Chem. Soc.*, 1895, ii, 85).—The author recommends evaporating the aqueous solution of kainite with the addition of platinum chloride, without any attempt at removing sulphates, lime compounds, &c. The residue is first extracted with alcohol to remove the excess of platinum chloride, and then with a solution of ammonium chloride to remove the impurities; a pure potassium platinochloride is thus obtained. The test-analysis was slightly higher than the usual result, but this is only natural, as the new process is not interfered with by occlusion of potash in the various precipitates, or by loss from decrepitation or volatilisation. L. DE K.

Estimation of Potash in Manures. By W. E. GARRIGUES (*J. Amer. Chem. Soc.*, 1895, ii, 47—51).—Ten grams of the sample is well mixed with strong sulphuric acid, in a platinum dish, and the whole is then gradually ignited until all the organic matter has been burnt off. The mass is now powdered, washed into a 500 c.c. flask with 250 c.c. of hot water, boiled for half an hour, and a 10 per cent. solution of barium chloride is cautiously added until no further precipitate is produced. A drop of phenolphthaleïn is introduced, and then, drop by drop, a solution of sodium carbonate until a faint, permanent rose colour is obtained. After cooling, the liquid is diluted to the mark, and 50 c.c. (1 gram) of the filtrate is used for the potash estimation. This is done, as usual, by evaporation with platinum tetrachloride and a drop of hydrochloric acid.

When analysing potash salts, the evaporation with sulphuric acid may be omitted. L. DE K.

Estimation of Potassium Sulphate in Wine. By L. HUGOUNENQ (*J. Pharm.*, 1895, [6], i, 349—354).—The author has proved that wine contains organic sulphur compounds, which afterwards are found in the ash as sulphates, and so increase the quantity of potassium sulphate by 30—40 per cent. To get a correct result, the estimation of the sulphuric acid must be made in the original sample, and not on the acid solution of the ash. The various sugars, tartrates, &c., contained in the wine have no particular influence on the accuracy of the result. L. DE K.

Reaction between Zinc Sulphate and Potassium Hydroxide. By C. E. LINEBERGER (*J. Amer. Chem. Soc.*, 1895, **17**, 358—360).—In works on analytical chemistry, it is customary to represent two molecules of potassium hydroxide as necessary to precipitate the zinc from one molecule of zinc sulphate. The precipitate is then supposed to redissolve by adding another two molecules of potash.

The author has experimentally proved that these ideas are quite erroneous, and that the reaction depends on temperature, dilution, and the relative masses of the components. In one experiment, 1·62 mols. of potassium hydroxide were sufficient to completely throw down a molecule of zinc, and in another trial not *two*, but 13·2 mols. of alkali were necessary to redissolve the molecule of zinc hydrate.

L. DE K.

Volumetric Estimation of Metals. By HENRI LESCOEUR (*Bull. Soc. Chim.*, 1895, [3], **13**, 280—281).—The author has for some years past used a process for the estimation of zinc in presence of free acid very similar to that described by Barthe (this vol., ii, 371), methyl-orange being substituted for the tincture of hollyhock. The precipitate obtained in this modified process is not, however, a basic sulphate, but the pure oxide of the metal. JN. W.

Estimation of Lead. By ANDREAS KREICHGAUER (*Zeit. anorg. Chem.*, 1895, **9**, 89—125; see also Abstr., 1894, ii, 217).—The paper contains a critical account of the electrolytic estimation of lead, and the results obtained with three different natural sulphides of lead, when analysed by the electrolytic method, by precipitation with bromine, and as sulphate, are compared. The precipitation with bromine is most convenient when the ores contain much antimony or zinc. The electrolytic method is adapted for products containing only small quantities of antimony, and especially when the product can be dissolved directly in nitric acid, and this process is generally the most accurate. The precipitation as sulphate is only advantageously employed when lead alone is present. E. C. R.

Quantitative Analysis of Galena. By PAUL JANNASCH and H. KAMMERER (*Ber.*, 1895, **28**, 1409—1411).—The authors recommend the following method for the analysis of galena. 0·7—0·75 gram of the finely powdered mineral is moistened with dilute nitric acid, and allowed to remain for several minutes, 10 c.c. of concentrated acid is then added, and the whole is heated on the water bath, and evaporated; nitric acid and water are then added, together with

10—15 drops of bromine, and the mixture is heated with continual stirring until all the sulphur is oxidised to sulphuric acid. In order to decompose any bromate which may be formed, the mixture should be evaporated to dryness three times with concentrated nitric acid. The residue is boiled with 60 c.c. of water and 20 c.c. of concentrated hydrochloric acid, and filtered from the insoluble residue (SiO_2, &c.), which is ignited and weighed. To estimate the lead, the filtrate is heated to boiling, and the clear solution poured at once into a mixture of 25 c.c. of water, 50 c.c. of hydrogen peroxide, and 50 c.c. of concentrated ammonia; the lead is thus thrown down as a yellowish-red, slightly crystalline precipitate, the composition of which will be determined later. The mixture is allowed to remain for several hours, with occasional stirring, the precipitate is then collected, washed with cold water, dried, and weighed in a platinum crucible as lead oxide. The filtrate is evaporated down, until the smell of ammonia has disappeared; 5 c.c. of concentrated hydrochloric acid and 5 c.c. of alcohol are added, the mixture again warmed, in order to destroy any persulphate which may be present, and the sulphuric acid is then precipitated by means of barium chloride. Impurities such as copper, nickel, zinc, and arsenic can be estimated in the filtrate from the barium sulphate. J. J. S.

Wet Copper Assay. By R. S. Dulin (*J. Amer. Chem. Soc.*, 1895, **17**, 346—351).—The most popular (American) assaying processes in the wet way are the electrolytic method, and the process by which the copper is precipitated by potassium iodide and the liberated iodine titrated, but these processes can only be employed in the absence of interfering metals or acids. The time-honoured cyanide process gives, however, excellent results, provided the copper is first precipitated with aluminium.

The copper ore is treated according to the directions given in Furmen's Manual of Assaying, the resulting solution being practically free from lead and silver; when boiled with strips of aluminium foil, the copper is completely precipitated, and if the boiling is then stopped at once, scarcely any cadmium will come down. The copper deposit is washed, dissolved in nitric acid, mixed with excess of ammonia, and titrated with potassium cyanide solution; in standardising the latter, as nearly as possible the same amount of copper, nitric acid, ammonia, &c., should be used in order to get trustworthy results. L. de K.

Quantitative Separation of Metals in Alkaline Solution by Hydrogen Peroxide. By Carl Engels (*Zeit. anorg. Chem.*, 1895, **9**, 78).—Regarding the paper by P. Jannasch and A. Röttgen with this title (this vol., ii, 331), the author states that he has been for some time engaged in the electrolytic separation of manganese from iron and copper in the presence of hydrogen peroxide and an organic compound. 0·5 gram MnO_2 can be estimated quantitatively by this method in one hour. E. C. R.

Electrolytic Estimation of Manganese. By Max Gröger (*Zeit. angw. Chem.*, 1895, 253—254).—Electrolytically deposited manganese peroxide has, according to Rüdorff, the composition, MnO_2,H_2O, when dried at 60°; using this formula, about 99 per cent. of manganese present is recovered during an analysis. The author has, however, proved that the precipitated manganese is not entirely in the state of dioxide, and if estimating it by means of potassium iodide and sodium thiosulphate, only 94—96 per cent. of the manganese will be found. L. DE K.

Methods for Estimating Manganese. By W. S. THOMAS (*J. Amer. Chem. Soc.*, 1895, **17**, 341—346).—The author has investigated some volumetric methods for estimating manganese with the object of finding out which process is most suitable for technical purposes.

The conclusion is, that the best method is the one proposed by Volhard, namely, titration of the manganous salt by means of potassium permanganate in presence of zinc oxide. Low's oxalic acid process, although theoretically perfect, has entirely failed in the author's hands. L. DE K.

Estimation of Iron in Ores, Slags, &c. By HANS VON JÜPTNER (*Chem. Centr.*, 1894, ii, 815; from *Österr. Zeit. Berg. Hütt.*, **42**, 469—470).—0·5 gram of the sample is mixed with 1 gram of magnesium powder and ignited for 5—10 minutes in a covered porcelain crucible; if the substance is very rich in ferrous oxide, 4—6 grams of magnesium should be used. The magnesium should be tested as to the amount of iron it contains.

The contents of the crucible is dissolved in dilute sulphuric acid and the iron estimated with standard permanganate. L. DE K.

Zimmermann-Reinhardt's Method for Estimating Iron in Iron Ores. By C. T. MIXER and H. W. DU BOIS (*J. Amer. Chem. Soc.*, 1895, **17**, 405—411).—The ore is dissolved in hot hydrochloric acid with the addition of stannous chloride, solution being complete in a few minutes. The excess of stannous chloride is removed by the addition of mercuric chloride, and the iron is then at once titrated with permanganate solution. To prevent injurious action of the hydrochloric acid on the permanganate, a solution of manganous sulphate also containing sulphuric and phosphoric acid is added before titration. The permanganate is checked by means of a standard iron ore, the composition of which has been ascertained in a variety of ways.

The authors, after a good many trials, strongly recommend this method for technical purposes. L. DE K.

Analysis of Steel. By H. K. BAMBER (*Chem. Centr.*, 1894, ii, 815; from *Stahl u. Eisen*, **14**, 872).—The sample is dissolved in dilute nitric acid, nearly neutralised with sodium hydroxide, and the liquid evaporated to dryness; the mass is then treated with 50 c.c. of 10 per cent. aqueous soda, again evaporated to dryness, and powdered. The powder is lixiviated with 0·5 per cent. aqueous soda, which then contains the various minor constituents such as phosphorus, arsenic, sulphur, chromium, vanadium, molybdenum, &c. L. DE K.

Estimation of Iron in Urine. By LOUIS LAPICQUE (*Bull. Soc. Chim.*, 1895, [3], **13**, 281—285).—See this vol., ii, 407.

Estimation of Nickel in Nickel-Steel. By EDWARD D. CAMPBELL and W. H. ANDREWS (*J. Amer. Chem. Soc.*, 1895, ii, 125—129).—*Preliminary Treatment.*—One gram of the sample is boiled in a 500 c.c. Erlenmeyer flask with 25 c.c. of nitric acid (sp. gr. 1·20) until dissolved, meanwhile, 13 grams of sodium pyrophosphate is dissolved in 75 c.c. of warm water, filtered, and added to the cooled nitric acid solution. A 20 per cent. solution of sodium carbonate is now slowly poured in until the ferric pyrophosphate has just dissolved, and the liquid attains a dull, olive-green colour; excess of soda, betraying itself by a red colour, must be carefully avoided. The liquid is now filtered through asbestos into a 500 c.c. Erlenmeyer flask, a solution of 2 grams of potassium xanthate in 25 c.c. of water is added, and the flask is stoppered and well shaken for about 10 minutes. The nickel is completely precipitated as xanthate, together with any copper, but is perfectly free from manganese and almost free from iron; the precipitate, collected on an asbestos filter, must be washed with a 1 per cent. solution of the reagent, which, in solution, does not keep more than 15 minutes.

The precipitate is dissolved off the filter by allowing 20 c.c. of nitric acid (10 c.c. of water, 10 c.c. of fuming acid) to slowly drop on to it; the filter is first washed a few times with hot water, then with 5 c.c of dilute sulphuric acid (2—3), and finally again with hot water. The solution is now rapidly boiled in an Erlenmeyer flask until the nitric acid is completely expelled, and fumes of sulphuric acid begin to be visible. After cooling, the residue is dissolved in 25 c.c. of water, heated nearly to boiling, a current of hydrogen sulphide passed through it to precipitate the copper, and the whole filtered. The filtrate is boiled to expel the gas, and the iron, oxidised by means of a few drops of hydrogen peroxide, or by a few particles of sodium dioxide, is at once precipitated by ammonia; the precipitate must, however, after washing, be redissolved in 5 c.c. of the dilute sulphuric acid, and again precipitated hot with ammonia so as to completely free it from nickel. In the united filtrates, the nickel may then be determined either by electrolysis or by titration.

Electrolytically.—The solution, mixed with 30 c.c. of 10 per cent. ordinary sodium phosphate and 25 c.c. of strong ammonia, is diluted to about 175 c.c., and placed in a platinum dish of 200 c.c. capacity; the nickel is then deposited on the platinum by means of a current of 0·14 ampère per 100 sq. cm. area of the dish, the electrodes being about 0·5 cm. apart.

Volumetrically.—To the liquid is added 5 c.c. of a solution of silver nitrate (0·05 per cent.), then 5 c.c. of a 2 per cent. solution of potassium iodide; solution of potassium cyanide (0·5 per cent.) is now run in until all the nickel has passed into double cyanide, which is indicated by the disappearance of the silver iodide. The cyanide solution is standardised by means of pure nickel wire, and a blank experiment is made to ascertain the amount of cyanide required to dissolve the silver iodide. L. DE K.

Separation of Metals with a Current of Carbonic Anhydride containing Bromine. By PAUL JANNASCH, ED. ROSE, and R. NIEDERHOFHEIM (*Zeit. anorg. Chem.*, 1895, 9, 194—204).—*Separation of Bismuth and Cobalt.*—For the test experiment, a mixture of metallic bismuth with cobalt ammonium sulphate was employed. A weighed quantity of the finely powdered substance, dried in a current of carbonic anhydride, whereby the greater part of the ammonium salt is eliminated, is mixed with about 10 times its weight of pure sulphur, heated in a current of dry hydrogen sulphide, and allowed to cool. The product is again heated with sulphur, and, after the excess of sulphur has sublimed, it is allowed to cool, and is treated with a current of dry carbonic anhydride saturated with bromine; meanwhile the tube containing the mixture is cautiously heated. Sulphur bromide sublimes at first, and then bismuth bromide, and the temperature must be regulated so that no lustrous spangles of cobalt bromide are formed; the volatile products are collected in dilute nitric acid. The green residue of cobalt bromide is dissolved in water, except a small black residue, which requires nitric acid to dissolve it; it contains no bismuth. The solution, heated to boiling, is precipitated with sodium hydroxide, and the cobalt weighed either as Co_3O_4 or as metallic cobalt. The nitric acid solution containing the bismuth is evaporated to dryness on the water bath, the residue dissolved in dilute nitric acid, and the bismuth precipitated with an excess of ammonia and hydrogen peroxide. The results obtained are accurate.

The separation of bismuth and nickel is performed in the same way as above. It is very difficult to dissolve the residual crystalline nickel compound in water, but it easily dissolves on the addition of acid.

Separation of Tin and Antimony from Lead and Copper.—The method is similar to that described above. The mixture of metals is weighed into a porcelain boat and heated in a tube of hard glass. Before treating with bromine, the sample to be analysed is heated with sulphur containing iodine. The bromine must be free from chlorine and water, and the carbonic anhydride from hydrochloric acid. In the separation of tin and lead, the residue of lead bromide can be weighed as such; it should give a clear solution in fresh chlorine water. In the separation of tin and copper, the solution containing the tin is first evaporated to dryness on the water bath, and is then heated in an air bath to drive off the sulphuric acid; the tin oxide obtained is heated until the weight is constant. The residue of copper, which is not pure cupric bromide, but contains cuprous bromide, is dissolved in dilute nitric acid, the solution evaporated to dryness, and the residue of nitrate ignited, and weighed; or the nitric acid solution is at once precipitated with sodium hydroxide. The separation of antimony from lead is very similar to that of tin from lead, but great care must be taken that no antimony sulphide is volatilised during the treatment with sulphur. The antimony solution is evaporated and freed from sulphuric acid as in the case of tin, it is then evaporated to dryness two or three times with fuming nitric acid, ignited, and the antimony weighed as antimony metantimoniate. Or the antimony is precipitated directly from the nitric acid solution as sulphide, the precipitate washed with a solution of ammonium nitrate containing hydrogen sulphide, dried at 80—90°, and then treated with fuming nitric acid, and the antimony weighed as dioxide. The separation of antimony and copper is performed in a similar way. E. C. R.

Quantitative Separation of Metals in Alkaline Solution by means of Hydrogen Peroxide.—12th Paper. By PAUL JANNASCH and H. KAMMERER (*Ber.*, 1895, **28**, 1407—1409).—(1) *Separation of Manganese and Silver.*—Silver nitrate (0·7—0·8 gram) and manganese-ammonium sulphate (0·7 gram) are dissolved in a mixture of water (10 c.c.) and concentrated nitric acid (10 c.c.); the solution thus obtained is poured into a mixture of water (20 c.c.), hydrogen peroxide (50 c.c.) and concentrated ammonia (40 c.c.) and the whole is heated on the water bath during 10—12 minutes. The precipitate is collected and washed, first with a mixture of water (8 parts by vol.), hydrogen peroxide (17 parts) and ammonia (17 parts), and finally with hot water. After ignition, the manganese is weighed as Mn_3O_4. The filtrate is heated on the water bath until the smell of ammonia has disappeared, nitric acid is added and the silver estimated in the usual way as chloride.

(2) *Separation of Bismuth and Cobalt.*—Cobalt ammonium sulphate (0·5 gram) and metallic bismuth (0·35 gram) are heated on the water bath with concentrated nitric acid (10 c.c.) and water (10 c.c.), until all is dissolved. The solution, after the addition of concentrated nitric acid (10 c.c.), is poured into a freshly prepared mixture of water (20 c.c.), hydrogen peroxide (50 c.c.), and concentrated ammonia (50 c.c.). The bismuth precipitate, which still contains a trace of cobalt, is collected and washed, first with a mixture of water, hydrogen peroxide and ammonia (see above), then with dilute ammonia, and finally with hot water. It is now dissolved in hot, dilute nitric acid, and concentrated acid is added in order to make up the total amount of concentrated acid present to 20 c.c. The precipitation is again repeated, and after washing as before, the precipitate is dried at 90°, and ignited and weighed in a platinum crucible as bismuth oxide. The filtrate containing all the cobalt is evaporated to dryness, and the residue heated in an air bath to drive off all ammonium salts; it is then dissolved in water to which hydrogen peroxide and a few drops of hydrochloric acid have been added, the solution heated to boiling, and the cobalt precipitated by the addition of a slight excess of pure sodium hydroxide, together with bromine; the precipitate is dried, ignited and weighed as Co_3O_4. The cobalt may also be directly precipitated from the ammoniacal filtrate by means of ammonium sulphide.

J. J. S.

Estimation of Paraffin in Crude Anthracene. By FRIEDRICH HEUSLER and JOS. HERDE (*Zeit. angw. Chem.*, 1895, 253).—The process is based on the fact observed by the authors that all the constituents of crude anthracene, paraffin excepted, are soluble in fuming nitric acid.

Two grams of the sample is put into a 150 c.c. flask, cooled in iced water, and very gradually mixed with 25 c.c. of fuming nitric acid; the mixture is then heated for a while on the water bath until the paraffin has melted, and again cooled. The solid mass is now collected on an asbestos filter, and after being washed with fuming nitric acid until this no longer becomes milky on adding water, the acid is removed by washing with water. The paraffin is first rinsed with alcohol into a weighed porcelain dish, and the spirit evaporated; in the meantime, the remaining paraffin is dissolved in hot ether, and this solution is also evaporated in the same dish. Before weighing, the paraffin is finally dried at 105—110° for half an hour. L. DE K.

Detection of Potassium Cyanate in small quantity, in Potassium Cyanide. By EDWARD A. SCHNEIDER (*Ber.*, 1895, **28**, 1540—1541).—The method is based on the formation of the deep-blue potassio-cobalt cyanate, $Co(CNO)_2,2KCNO$. The potassium cyanide in the liquid under examination, which must be as concentrated as possible, is decomposed by means of a current of carbonic anhydride. Alcohol (90—95 per cent.) is added, to precipitate the potassium carbonate, and the filtrate treated with a few drops of acetic acid, and then with cobalt acetate solution. In this way, the presence of 0·0033 gram of potassium cyanate in 100 c.c. of liquid may be detected. The decomposition of 3 grams of potassium cyanide (10 per cent. solution) occupies about 45 minutes. When larger quantities have to be employed, the salt is dissolved in the smallest possible quantity of water and mixed with alcohol so as to precipitate most of the cyanide, the filtrate being then treated with carbonic anhydride as above. The presence of 1—0·35 parts of cyanate in 100 parts of cyanide is easily detected. Aqueous solutions of potassium cyanate are less stable than alcoholic, but the former do not decompose so readily as is generally stated, in one experiment 50 c.c. of potassium cyanate solution (1 per. cent.) gave the cobalt reaction after being rapidly boiled for an hour; heating, even of alcoholic cyanate solutions intended for analysis, should be avoided.

J. B. T.

Discrimination between Lactose and Glucose in Adulterated Peptones. By L. RUIZAND (*J. Pharm.*, 1895, [6], i, 232—233).—Five grams of the sample is dissolved in 45 c.c. of water and 5 c.c. of hydrochloric acid, heated for two hours in a water bath at 70°, and neutralised with aqueous soda; the liquid, which may now contain glucose and galactose, is mixed with 12 grams of sodium acetate and 8 grams of phenylhydrazine hydrochloride, and again heated for an hour. The whole is then filtered boiling; phenylglucosazone is insoluble, but the galactose compound is soluble, and crystallises out on cooling; after washing and recrystallising from hot water, it is dried, and its melting point is taken; this should be 188—191°.

A more simple test is based on the fact that neutral copper acetate is reduced by glucose, but not by lactose. If, however, the latter is first inverted by treating with acid, as described, it also reduces the copper. L. DE K.

Identification and Estimation of Carbohydrates in Milk. By ALEXANDER WYNTER BLYTH (*Analyst*, 1895, **20**, 121—126).—The paper is chiefly devoted to an improved process of recognising and estimating added sugars in milk; 25 c.c. of milk is diluted to 50 c.c. with water, and acetic acid is added drop by drop, until the caseïn separates. After heating to boiling, the liquid is whirled in a glass cylinder by the aid of a centrifugal machine. The bulk of the proteïd and fatty matters separate, and adhere to the bottom of the cylinder, and the supernatant liquid is easily filtered. The filtrate may be examined polarimetrically, and the reducing sugars estimated by the copper cyanide process.

To identify foreign sugars with certainty, it is well to prepare the osazone; in this case, the filtrate is evaporated down to 30 c.c., and the filtered liquid mixed with 2 grams of sodium acetate, and 1·5 gram of phenylhydrazine hydrochloride. After warming for an hour and a half in a water bath, it will be found that, on cooling, the liquid becomes almost solid; the crystals are collected, pressed between blotting paper. and dried in a water oven. The osazone is then boiled with absolute alcohol (30—40 c.c.), and when dissolved allowed to stand over night; if glucose or invert sugar is present in the milk, well defined crystals will separate. The alcoholic filtrate is now heated to boiling on the water bath, water is added until a slight turbidity shows itself, and the whole is then allowed to slowly evaporate, when the osazone will crystallise out. If entirely due to lactose it looks under the microscope as aggregations of warty masses, but if partly due to glucose, bundles of needle-shaped crystals will be noticed. L. DE K.

Melitriose (Raffinose) and its Estimation. By A. BAU (*Chem. Zeit.*, 1894, **18**, 1794—1799).—After a detailed historical account of the discovery and investigation of raffinose, the author describes his investigation of its behaviour towards yeast, and his experiments on its estimation. Raffinose crystallises in long, pointed needles, the specific refractive power $[\alpha]_D = +104·0$, and it yields an undecacetyl derivative. These properties are given incorrectly in many textbooks. The experiments with yeast were all performed with pure cultures and sterilised solutions; the results show that it is quite unfermentable with bottom fermentation yeast, and only partially so with top fermentation yeast, as the melibiose which is formed undergoes no change. From experiments with *Monilia candida*, it is almost certain that raffinose is not directly fermentable. The presence of raffinose in barley has been demonstrated by the preparation of the osazone from the fermented and purified extract. Of the various methods proposed for the estimation of raffinose, the fermentation one gives, as a rule, the most satisfactory results; the solution of the substance (10—12 per cent.) is mixed, if needful, with nutritive solution, sterilised, and divided into four portions. two of these are treated with top fermentation, two with bottom fermentation yeast, pure cultivations being employed; the time required for fermentation is at least 10—14 days; the liquid is made up to its original weight with sterilised water, filtered, and the filtrate analysed (polarisation, cupric reducing power, and extractive matter), the difference between the extract of the two fermentations, multiplied by 1·737, gives the amount of raffinose. No correction is necessary for the yeast. Reference is made to E. Fischer and Thierfelder's experiments on the fermentability of galactose (Abstr., 1894, i, 486). J. B. T.

Estimation of Starch. By P. L. Hibbard (*J. Amer. Chem. Soc.*, 1895, ii, 64—68).—A weighed quantity of the sample, containing at least 0·5 gram of starch, is placed in a flask with 50 c.c. of water, and 1—2 c.c. of malt extract, prepared by soaking coarsely pulverised malt with water containing 20 per cent. of alcohol. The mixture is at once heated to boiling, shaking frequently, to prevent formation of insoluble clots. If, however, the material is poor in starch, the addition of malt is at first omitted; the liquid is boiled for a minute, and when again cooled down to 50—60°, 2—3 c.c. of malt solution is added; it is then again slowly heated to boiling, and tested for starch with iodine. When all the starch has disappeared, the mixture is cooled, made up to a definite bulk, and filtered through fine muslin; an aliquot part of the filtrate, corresponding with about 0·3 gram of starch, is then placed in a 100 c.c. flask with 5 c.c. of 30 per cent. hydrochloric acid, and sufficient water to make up to 60 c.c. This solution is now boiled gently for 30 minutes on a sand bath, then cooled, nearly neutralised with aqueous soda, and the dextrose estimated with Fehling's solution. A blank experiment is, of course, made to ascertain the amount of dextrose yielded by the malt extract. L. de K.

Detection of Formalin. By H. Droop Richmond and L. Kidgell Boseley (*Analyst*, 1895, **20**, 154—156).—Guided by Pulvermacher's researches on compounds of formaldehyde with substituted ammonias, the authors have worked out the following process:—Diphenylamine is dissolved in water with the aid of sulphuric acid; the liquid to be tested (milk for instance) is distilled, the distillate added to the reagent, and boiled. In the presence of formaldehyde, a white, flocculent precipitate is deposited which occasionally may be green, due to nitric compounds in the sulphuric acid. L. de K.

Estimation of Furfuraldehyde in Pentoses and Pentosans. By B. Welbel and S. Zeisel (*Monatsh.*, 1895, **16**, 283—311).—The authors base their method of estimating furfuraldehyde in pentoses and pentosans on the observation that in presence of a 12 per cent. solution of hydrochloric acid, phloroglucinol and furfuraldehyde condense in the cold, and even more readily on heating, forming a dark coloured, insoluble compound. This compound can be collected in a tared asbestos filter, dried at 100—110°, and weighed. G. T. M.

Detection of Salicylic acid in Wines. By Matteo Spica (*Gazzetta*, 1895, **25**, i, 207—216).—The ferric chloride test for salicylic acid, although satisfactory for the examination of beers, is of less value in the case of wines, as the ether used in extraction takes up small quantities of tartaric, tannic, and acetic acids, together with the salicylic acid, and so masks the colour test.

The author uses a modification of Röse's method by which the wine is extracted with ether, the ethereal solution evaporated, and the residue taken up by light petroleum, in which tartaric acid is insoluble; the ferric chloride test is then applied to the residue obtained on evaporating the petroleum solution. Should the colour obtained be faint, it is well to render the wine alkaline and concentrate before extracting; in order to prevent the repetition of the process thus involved, the residue obtained on evaporating the ethereal solution is warmed with concentrated nitric acid, rendered alkaline with ammonia, and the solution heated with a thread of white wool previously freed from grease by potash and ether. The presence of salicylic acid is betrayed by the yellow colour given to the wool by the picric acid produced; the test is not affected by the presence of tartaric, tannic, or acetic acid, and is sensitive to 0·02 milligram of salicylic acid per litre of wine if 10—25 c.c. of the latter is used. W. J. P.

Maumené's Test for Oils. By H. Droop Richmond (*Analyst*, 1895, **20**, 58—59).—The calorimeter used by the author consists of a small, deep beaker fitted inside a slightly larger one by means of a ring of cork; the outer beaker being placed in a tin cup padded with cotton-wool. Its heat capacity is estimated by placing 10 grams of water inside, noting the temperature, and pouring in 25 grams of hot water (of known temperature), and observing the resulting temperature.

The total heat evolved in a Maumené experiment, which the author calls the *relative molecular Maumené figure*, is calculated from the equation

$$\text{R.M.M} = \text{R} \times \frac{21{\cdot}5}{x - 78{\cdot}5} \times \frac{20 + h}{20} \times \frac{19{\cdot}5}{\text{K}},$$

in which R is the observed rise in temperature from 25 grams of oil and 5 c.c. of sulphuric acid, x its percentage of real sulphuric acid (which must not be below 92°), h the heat capacity of the calorimeter in grams of water, and K the potash absorbing figure of the sample, 19·5° being taken as the average. L. de K.

New Thermal Method for Examining Oils. By Otto Hehner and Charles A. Mitchell (*Analyst*, 1895, **20**, 146—150).—The authors prefer using bromine instead of sulphuric acid when testing oils for rise in temperature.

One gram of the oil is dissolved in 10 c.c. of chloroform and introduced into a vacuum-jacketed test-tube. A delicate thermometer is put in, and, after noticing the temperature, 1 c.c. of bromine is added, and the increase in temperature observed. The authors have tabulated the results of 31 samples of oil and fat. In nearly every case the iodine absorption figure agreed very well with the rise in temperature, and could be calculated by multiplying the latter by 5·5.

L. de K.

Gravimetric Estimation of Bromine Absorption of Fats. By Otto Hehner (*Analyst*, 1895, **20**, 49—52).—The author has found that the compounds of fats with bromine may be dried at 125° without loss, and has based on this fact a gravimetric process for determining the bromine absorption of fats.

From 1—3 grams of the sample is introduced into a small wide-mouthed flask and carefully weighed. The fat is dissolved in a few c.c. of chloroform, and bromine is then added until it is decidedly in excess. The flask is heated on the water bath until most of the bromine is driven off, a little more chloroform is added, and the mixture again heated, the chloroform vapour expelling the excess of bromine. The residue is then dried at 125° until the weight is constant.
L. de K.

Hübl's Iodine Absorption Method. By Julius Ephraim (*Zeit. angw. Chem.*, 1895, 254—259).—The author has investigated the nature of the Hübl's solution (iodine and mercuric chloride dissolved in alcohol), and thinks that, as its action is chiefly due to chloride of iodine, it is more convenient to make an alcoholic solution of iodine monochloride instead. This should contain 16·25 grams of the compound per litre.
L. de K.

The Amorphous Nitrogenous Organic Compounds in Beer Wort. By N. C. Henrik Schjerning (*Zeit. anal. Chem.*, 1895, **34**, 135—147).—It is first shown that one of the statements in the earlier paper (Abstr., 1894, ii, 371) requires correction. The stannous chloride precipitate is not identical with the absolute baryta precipitate (abs. Ba), but with the absolute lead precipitate (abs. Pb = Pb − abs. Ba): the absolute baryta precipitate is therefore the same as Pb − Sn, and is best estimated by subtracting the amount of the stannous chloride precipitate from the amount of the lead acetate precipitate.

The author then proceeds to determine the amount of nitrogen extracted from malt by one hour's mashing at different temperatures, ranging from 25° to 100°, and the proportion of the nitrogen precipitated by each of his four reagents (Ba — or rather Pb − Sn, Sn, Fe, and Ur, *loc. cit.*), from each of the worts thus obtained; the greatest solubility for the nitrogenous constituents of malt, as well as the highest degree of peptonising is found at about 60°. The amount of ammonia extracted is the same at all temperatures, and is not altered by subsequent boiling of the wort for three hours. The general results seem to support Mulder's hypothesis of the derivation of the amorphous nitrogenous organic compounds in wort from a single highly complex proteïd. The curves representing the changes in the amounts of the different precipitates as the temperature of mashing is varied indicate that the peptones are formed at the expense of the albuminous substances, and the propeptone chiefly at the expense of the material which the author has provisionally called "denucleïn."
M. J. S.

General and Physical Chemistry.

Emission of Light during Crystallisation. By ERNST BANDROWSKI (*Zeit. physikal. Chem.*, 1895, **17**, 234—244).—The author, who has repeated Rose's experiments with arsenious anhydride and potassium sulphate, contests his conclusion, that the emission of light during crystallisation is due to the change from an amorphous to a crystalline state. He finds that both the crystalline and amorphous varieties of arsenious oxide emit light during crystallisation, and that these phenomena can be reproduced as often as desired by redissolving and cooling. He considers that the effect is probably due to the formation and decomposition of an arsenious salt, $As_2O_3 + 6HCl \rightleftharpoons 2AsCl_3 + 3H_2O$, and in support of this he has noticed that a hot solution of the trichloride on cooling slowly deposits the anhydride with strong development of light. The experiments with potassium sulphate are in many cases contradictory to those of Rose, and the author finds that in all cases where light is emitted the composition of the crystals corresponds with the formula $2K_2SO_4 + Na_2SO_4$, so that the effect is probably chemical, and connected with the formation of this double salt. In all the cases, the character of the light effects are quite different from those previously described (this vol., p. 6). L. M. J.

Molecular and Atomic Refraction. By W. F. EDWARDS (*Amer. Chem. J.*, 1895, **17**, 473—506).—The author has lately (this vol., ii, 193) proposed a new form of molecular "refraction equivalent," $P(\mu - 1)/D\mu$, in place of the well-known ones of Gladstone, $P(\mu - 1)/D$, and Lorentz and Lorenz, $P(\mu^2 - 1)/D(\mu^2 + 2)$; where μ = index of refraction, D = density, P = molecular weight. He has now calculated, from the original data, the values of these three

	Gladstone. $\frac{P(\mu-1)}{D}$.	Lorentz-Lorenz. $\frac{P(\mu^2-1)}{D(\mu^2+2)}$.	Edwards. $\frac{P(\mu-1)}{D\mu}$.
Hydrocarbons, aliphatic..	7·74	4·56	5·25
,, aromatic..	8·00	4·75	4·44
Alcohols, aliphatic	7·68	4·62	5·28
,, aromatic.......	7·48	4·45	5·14
Aldehydes, aliphatic	7·69	4·58	5·24
Acids, ,, ...	7·65	4·61	5·31
Ethereal salts, ,, ...	7·68	4·62	5·34
Chlorides, ,, ...	7·87	4·65	5·39
Bromides, ,, ...	7·89	4·60	5·39
Iodides ,, ...	7·94	4·69	5·37
Amines, ,, ...	8·15	4·69	5·50
,, aromatic	7·72	4·58	5·27
Nitriles, aliphatic	7·85	4·68	5·36

refraction equivalents, for sodium light, in the case of a number of liquids; and he finds that if, in different classes of organic substances, these values are used to determine the value of CH_2, variations in the mean numbers thus obtained for CH_2 in the different classes are distinctly less when his form of the refraction equivalent is used than with the two others; this is shown by the preceding table, which gives these values of CH_2.

The values of the atomic refractions were then calculated in the usual way, and are given in the table below; they are the means of the numbers regarded as most trustworthy. It is not clear whether the presence of an "isolated" carbon atom, as in methylic alcohol, &c., does or does not raise the molecular refraction equivalent above the normal value. A double linking certainly does, and apparently by different amounts in the aliphatic and aromatic series; the individual numbers differed so widely in the first case, however, that the mean of those obtained in the aromatic series was regarded as the true value of a double linking of carbon atoms. Oxygen has, as usual, two values, as "hydroxyl-oxygen" ($-O\cdot H$) and as "carbonyl-oxygen" ($>C\!:\!O$); but if the new refraction equivalent is used, it is found to have yet a third value, namely, when it exists as "ether-oxygen" ($\geqslant C\cdot O\cdot C\leqslant$); this third value was not calculated from the ethers themselves, data as to which are not considered in this paper, but from the ethereal salts of the fatty acids. Sulphur has also two values, as "thiohydroxyl-sulphur" ($-S-$) in aliphatic hydrosulphides and sulphides, and as "thiocarbonyl-sulphur" ($>C\!:\!S$) in xanthates and thiocarbonates. Nitrogen has different values according as it exists in primary amines ($-NH_2$), in secondary amines ($>NH$), in tertiary amines, pyridine, &c, ($\geqslant N$), or in cyanides ($-C\!:\!N$).

	$\frac{P(\mu-1)}{D}$.	$\frac{P(\mu^2-1)}{D(\mu^2+2)}$.	$\frac{P(\mu-1)}{D\mu}$.
Carbon	4·68	2·45	2·01
Double bond	2·88	1·81	2·66
Hydrogen	1·50	1·08	1·64
Oxygen, hydroxyl	2·70	1·46	1·59
„ ethereal	2·73	1·53	2·13
„ carbonyl	3·25	2·35	3·38
Sulphur, thiohydroxyl	13·47	7·66	8·36
„ thiocarbonyl	19·76	11·02	11·85
Nitrogen, primary	5·01	2·49	1·99
„ secondary	5·09	2·71	2·35
„ tertiary	5·54	3·26	3·13
„ in cyanides	4·63	3·20	4·79
Chlorine	10·11	6·03	7·20
Bromine	15·32	8·84	9·95
Iodine	25·09	14·01	15·22

C. F. B.

Spectra of Gases evolved from various Minerals. By J. Norman Lockyer (*Compt. rend.*, 1895, **120**, 1103—1104).—The author has heated 18 minerals, including uraninite, in a vacuum, and examined the spectra of the gases given off. The various spectra contain altogether about 60 lines which do not coincide with lines of any known terrestrial bodies. Seventeen lines have been photographed, and their wave-lengths (on Rowland's basis) are as follows.

3889 (1, 2, 3)
3947 (1, 2)
3982 (2)
4026·5 (2, 3)
4142
4145 (2, 3)
4177 (2, 3)
4182
4338 (1, 3)
4347 (3)
4390 (1, 2, 3)
4398 (1, 2)
4453 (2).
4471 (1, 2, 3).
4515 (1, 2).
4522 (1, 2).
4580
—

Those marked (1) seem to be identical with lines of unknown origin observed in the sun's chromosphere, those marked (2) with lines photographed during the eclipse of 1893, and those marked (3) with lines in the white stars of Orion. C. H. B.

Spectra of Gases from Cleveite, and the Solar Spectrum. By Henri Deslandres (*Compt. rend.*, 1895, **120**, 1112—1114).—The gas from Cleveite, (1) in a vacuum at the ordinary temperature, (2), in a vacuum at 300°, and (3), after heating with sulphuric acid in a vacuum, was examined separately. The gas given off at the ordinary temperature showed some of the lines of argon; that given off at 300° contained a considerable quantity of an oxygen compound of carbon, whilst that evolved on treatment with acid showed the line D_3 and many other strong lines, the wave-lengths and intensities of which are as follows.

λ.	Intensity.	λ.	Intensity.	λ.	Intensity.
*6678·0	5	*4437·9	4	3819·7	5
*5876·0	10	*4388·4	6	*3705·4	4
*5048·4	4	4143·9	5	3613·8	5
*5016·0	9	4120·9	5	3447·7	4
*4922·2	6	4026·2	8	*3187·9	7
*4713·35	7	*3964·0	7	2945·7	5
*4471·75	8	*3888·75	10	—	—

The first six were observed by Cleve, and those marked * have been observed in the sun's chromosphere. With the exception of D_3, the author did not observe the lines described by Crookes.

The gas from Cleveite shows, in addition to the line D_3, several strong lines observed in the chromosphere, and notably the line 4471 8, which is always present in the chromosphere. It follows that the number of lines constantly observed in the sun and not corresponding with lines shown by terrestrial substances is reduced to two.

Some of the lines from Cleveite do not show the same relative intensity as compared with D_3 as in the solar spectrum. It would seem therefore that the gas is a mixture or a compound, and this is supported by the fact that in the spectrum tube D_3 is only seen at the positive pole and in the capillary portion, whilst the line 501 is very brilliant at the negative pole. C. H. B.

Variations observed in the Spectra of Carbon Electrodes. By W. Noel Hartley (*Proc. Roy. Soc.*, 1894, **55**, 344—349).—This paper contains a reply to Eder and Valenta's criticisms (*Akad. Wiss. Denksch. Wien.*, 1893, **60**) on a previous paper by Hartley and Adeney. The author still thinks that the lines with the wave-lengths 3881·9, 3870·7, 3589·9, 3584·8, are carbon lines, and not the edges of cyanogen bands, as Eder and Valenta state. These same lines are obtained from the combustion of cyanogen and from carbon electrodes surrounded by saline solutions, but are not given by cyanides. A list is given of the lines which appear under different circumstances when condensed sparks are passed between graphite electrodes. This list includes the lines of dry electrodes in air, in carbonic anhydride, and in oxygen. J. J. S.

Flame Spectra at High Temperatures. Part II. Spectrum of Metallic Manganese, of Alloys of Manganese, and of Compounds containing that Element. By W. Noel Hartley (*Proc. Roy. Soc.*, 1894, **56**, 192—193).—Photographs of the spectra of metallic manganese and of manganic oxide were taken and compared. They were also compared with the spectra of the alloys of manganese. The periods of exposure varied from a mere flash in the case of Spiegeleisen when poured into a Bessemer converter, to 30 minutes, and even as much as 80 minutes with manganic oxide. The leading features of the spectra of manganese and manganese oxide are the same, but they differ in detail, as may be observed by comparing the wave-lengths of the lines and bands in their respective spectra. A striking group of lines, the most persistent in the whole of these spectra, is situated in the violet. The following measurements were made:—4036·5, 4032·0, 4029·5. Another line is just visible about 4031·8, but it is so close to 4032·0 that it could be discerned only when the extreme points of three very strong lines were examined, and the plate was in perfect focus for that region. E. C. R.

Flame Spectra at High Temperatures. Part III. The Spectroscopic Phenomena and Thermo-Chemistry of the Bessemer Process. By W. Noel Hartley (*Proc. Roy. Soc.*, 1894, **56**, 193—199). —The constitution of the Bessemer spectrum is a complex one, which exhibits differences in constitution during different periods of the "blow" and even during different intervals in the same period. As originally observed by Watts, the spectrum differs at different works, the difference being due to temperature and to the composition of the metal blown. During the first period, the lines of the alkali metals, sodium, potassium, and lithium are seen unreversed on a bright continuous spectrum caused by carbon monoxide. The C line of hydrogen and, apparently, the F line, were seen reversed during a snowstorm. During the second period, the "boil," bands of manganese are prominent, overlying the continuous spectrum of carbon monoxide. There are lines of carbon monoxide, manganese, and iron, also those of the alkali metals. During the third period, the "fining stage," the spectrum is the same as the foregoing, but the lines of iron are not so strong and not quite so well defined. Some of the short lines disappear. The lines of the alkali metals are visible. No absorption bands were seen, no nitrogen bands, nor bands of calcium, or magnesium oxide, neither did the lines of these metals appear. There is no trace of cobalt, nickel, chromium, or copper. Some of the lines not identified by Watts prove to be iron lines, others belong to manganese.

The non-appearance of the lines of manganese at the commencement and termination of the blow is owing to the quantity of metal volatilised at these periods being insufficient for the production of a spectrum. At the commencement, the temperature is too low. The alkalis come from the ganister lining of the converter, and do not show themselves until a layer of slag has been formed and the temperature has risen sufficiently high for their basic constituents to be vaporised. At the temperature of the "boil," metallic manganese and iron are freely vaporised in a current of carbon monoxide, which, in a highly heated state, rushes out of the bath of molten metal. When the metal blown contains but little manganese, this is all converted into silicate during the first period. The manganese spectrum of the flame does not arise from that substance being contained in the bath of metal, it must be vaporised from the slag. This has been proved by photographs of the spectrum from samples of slag obtained from the Crewe works. The luminosity of the flame during the "boil" is due not merely to the combustion of highly heated carbonic oxide, but also to the presence of the vapours of iron and manganese in the gas. The disappearance of the manganese spectrum at the end of the "fining stage" is primarily due to a reduction in the quantity of heated carbon monoxide, and also, when the last traces of carbon are gone, to the oxidation of the manganese by the blast. The probable temperature of the Bessemer flame at the finish is that produced by the combustion in cold air of carbonic oxide heated to about 1580°. Judging by the lines and bands of iron and manganese which have been measured in photographed spectra of the Bessemer flame, the temperature must nearly approach 1775°. From thermochemical data, the heat evolved during the "blow" has been calculated. If we allow for 50 per cent. of the heat developed at high temperatures being lost by radiation or absorbed, then the estimated temperature of the metal in the converter is more than 1900°. E. C. R.

Absorption Spectra of Dilute Solutions. By Thomas Ewan (*Proc. Roy. Soc.*, 1894, **56**, 286—287).—The absorption spectra of solutions of cupric sulphate, chloride, bromide, and nitrate, containing 0·003 to 0·004 gram mol. per litre were found to be, within the limits of experimental error, identical. Solutions of cupric acetate absorb, for the same amount of copper, much more light than those of the other salts used. The difference tends to disappear as the solutions become more dilute, and it is increased by the addition of acetic acid. The difference is due to the incomplete electrolytic dissociation of the salt, and to the undissociated part having an absorption spectrum differing from that of the dissociated part. Dilute solutions of the potassium and ammonium derivatives of α-dinitrophenol [1 : 2 : 4] were found to have very nearly the same absorption spectrum.

The mean of the numbers obtained was regarded as the absorption spectrum of the ion $C_6H_3(NO_2)_2O$. The solution of dinitrophenol in hydrochloric acid absorbs very little light; it is almost colourless. The extinction coefficients of dinitrophenol and of its coloured ion, being thus known, it was possible to calculate from measurements of the extinction coefficients of a series of solutions of dinitrophenol in pure water, its degree of dissociation in these solutions. The numbers obtained agreed satisfactorily with the numbers calculated from the electrical conductivity of the solutions.

By filtering dilute solutions of ferric chloride through a porous cell all the colloïdal ferric hydroxide formed can be removed; and the analysis of the solutions before and after filtration showed that the hydroxide formed in solutions containing less than 0·005 gram mol. of $FeCl_3$ per litre, contains no chlorine. The photometric determinations of the quantity of ferric hydroxide formed in these solutions agreed fairly well with the results of the filtration experiments. The quantities of ferric hydroxide found are not in agreement with the law of Guldberg and Waage, but agreed much better with Arrhenius' modified law. Solutions of ferric hydroxide obtained by dissolving ferric chloride in a very large quantity of water, had a different absorption spectrum from that of solutions of ferric hydroxide obtained by dialysis. Solutions of ferric chloride, to which small quantities of hydrochloric acid have been added, possess such comparatively small power of absorbing light that they cannot be regarded as containing any colloïdal ferric hydroxide. E. C. R.

Researches on Modern Explosives. By WILLIAM MACNAB and E. RISTORI (*Proc. Roy. Soc.*, 1894, **56**, 8—19).—The explosives used in these experiments can be divided into three classes. (1.) Those consisting of nitrolignin or nitrocellulose (not gelatinised), mixed or impregnated with a suitable nitrate, and mixed with colouring matters and some other substances, for the purpose of retarding the rate of combustion. (2.) Those containing purified nitrolignin or nitrocellulose gelatinised by a suitable process, and with or without the addition of nitrobenzene or other suitable nitrates. (3.) Those containing nitrocellulose combined with nitroglycerin, with the addition of aniline, camphor, vaseline, or other kindred substances. Also a series of samples of ballistite were specially made, containing nitroglycerin and nitrocellulose in various proportions. Using a bomb of 247·6 c.c. capacity, with a density of loading of $\Delta = 0·1$, *i.e.*, with a charge of 24·76 grams, the average of the pressures measured was 6·3 tons per square inch; with density $\Delta = 0·2$ the pressure rose to 15 tons, and with $\Delta = 0·3$ the pressure increased to 25 tons. The amount of heat generated by the explosion, the volume and composition of the permanent gases produced, and the quantity of aqueous vapour formed, were ascertained. The average weight of the products of explosion, calculated from the results found, amounts to 99·7 per cent. of the weight of the explosive fired. The use of highly nitrated cellulose increases the quantity of heat developed, and diminishes the volume of gas; the composition of the permanent gases is also altered, there being an increase in carbonic anhydride and a decrease in carbonic oxide and hydrogen. When a smaller proportion of explosive in comparison with the air is present, the combustion is more complete, and the heat developed is greater. The reaction which takes place with an explosive containing 50 per cent. of nitroglycerin and 50 per cent. of nitrocellulose may be expressed by the following equation:

$$6C_3H_5(NO_3)_3 + 2C_6H_7(NO_3)_3O_2 + 3C_6H_8(NO_3)_2O_3 = 25CO_2 + 23CO + 4H_2 + 15N_2 + 30H_2O.$$

Complete tables of the results are given in the paper. E. C. R.

Heats of Solution and Dissociation. By MAX RUDOLPHI (*Zeit. physikal. Chem.*, 1895, **17**, 277—300).—Owing to the difficulty of directly determining the heat of solution of sparingly soluble salts, the author investigates thermodynamically an expression for this value. The expression $W = -1{\cdot}98\ T^2/C_1 \,.\, dC/dT$ is obtained if no dissociation occurs, C being the molecular concentration and W the molecular heat of solution. The correction to be applied, owing to dissociation, is next determined, the expression $-Q/T^2 = (1/C + 2/C_2)$, dC_2/dT being obtained where C_1 and C_2 are the concentrations of undissociated salt and ion respectively. The salts examined were the acetate, propionate, butyrate, isobutyrate, and isovalerate of silver, the necessary solubility values being taken from the determinations of Raupenstrauch and Sedlitzky. The dissociation values were obtained by determinations of the conductivity by Kohlrausch's method, the conductivity of the corresponding sodium salts, and of the nitrates of sodium and silver, supplying the values at infinite dilution. The values for the heat of solution of saturated solutions are thus obtained ($L = Q\ \lambda_v/\lambda_\infty + W$), and recorded in the accompanying table.

	Acetate.	Propionate.	Butyrate.	Isobutyrate.	Isovalerate.
25° ..	−3·120	−4·103	−3·005	−2·357	−3·205
30 ..	−3·366	−3·433	−2·954	−2·051	—
35 ..	−3·150	−3·112	−4·200	−2·019	−4·181

L. M. J.

Isomeric Changes of Mercury Compounds. By RAOUL VARET (*Compt. rend.*, 1895, **120**, 1114—1115).—Determinations of the thermal disturbances accompanying the dissolution of the various forms of mercuric sulphide in a saturated solution of sodium sulphide in sodium hydroxide solution of sp. gr. 1·4, lead to the following results.

HgS black amorphous	= HgS red amorphous	develops	+0·24 Cal.
HgS ,, ,,	= HgS red crystallised	,,	+0·30 ,,
HgS red amorphous	= HgS red crystallised	,,	+0·06 ,,

C. H. B.

Thermochemical Relations between Aldehydes, Alcohols, and Acids. By MARCELLIN BERTHELOT and PAUL RIVALS (*Compt. rend.*, 1895, **120**, 1086—1095).—Determinations by means of the calorimetric bomb gave the following results.

	Heat of combustion (constant pressure).	Heat of formation (carbon as diamond).
Saligenol	846·0 Cal.	+ 90·1 Cal.
Salicylaldehyde	807·6 ,,	+ 59·5 ,,
Pyromucic acid	493·8 ,,	+115·7 ,,
Furfuraldehyde	559·8 ,,	+ 49·7 ,,
Campholenic acid, solid	1365·9 ,,	+129·1 ,,
,, ,, liquid	1363·3 ,,	+131·7 ,,
Campholic acid	1409·2 ,,	+154·8 ,,

Saligenol is both an alcohol and a phenol, and its heat of formation is +21·3 Cal. less than that of the isomeric dihydric phenol, orcinol. A similar difference, +15 Cal., is observed between benzylic alcohol and ortho- and para-cresol, and in all cases the conversion of an alcoholic function into a phenolic function is accompanied by a considerable development of heat, correlated with the increased general stability and the increased activity of the acidic function. The differences in question do not correspond with any relation between phenols and tertiary alcohols.

Comparison between the values for salicylaldehyde and benzoic acid shows that the change from aldehyde-phenol function to acid function develops +34·7 Cal., which is greater than the thermal disturbance usually accompanying the change from alcohol-phenol to diphenol. The oxidation of saligenol to salicylic acid develops +111·0 Cal., and the oxidation of salicylaldehyde to acid +72·6 Cal., whilst the direct hydrogenation of salicylaldehyde with formation of saligenol develops +30·6 Cal.

Comparison of the heat of formation of pyromucic acid with that of mucic acid, +426·9 Cal, shows that the difference, +301·3 Cal., corresponds exactly with the heat of formation of $CO_2 + 3H_2O$, which agrees with the relation established in the case of other pyrogenic acids.

Furfuraldehyde contains hydrogen and oxygen in the same proportions as in water, and if the heat of formation of the aldehyde is subtracted from that of the water, the difference, +88·3 Cal., is the excess of energy possessed by a molecule of furfuraldehyde, regarded as a hydrate of carbon, or, in other words, the excess of its heat of combustion over the heat of combustion of the carbon which it contains. Glucose, when regarded in the same way, has an excess of energy of +91·4 Cal.; pyrogallol, which has a very different function, an excess of +77·5 Cal., acetic acid an excess of +18·3 Cal. for C_2 or +54·9 Cal. for $3C_2$. It follows, that compounds which may be regarded as hydrates of carbon, although having very various functions, retain, as a rule, an excess of energy, a fact which it is essential to keep in mind in all investigations concerning animal heat, or in estimating the heating power of combustibles. The excess calculated for the same number of carbon atoms is highest in the case of alcohols and aldehydes, less in the case of phenols, and still less in the case of acids, each of these changes of function being accompanied by a special development of heat, even in the case of isomerides.

In the case of arabinose, which readily splits up into furfuraldehyde and water, the excess is +17·1 × 5 or +85·6 Cal., and is of the same order of magnitude as in the case of glucose. The conversion of arabinose into furfuraldehyde corresponds with a thermal disturbance of only −2·2 Cal.

The product formed by the spontaneous condensation of furfuraldehyde has the composition $C_{15}H_{10}O_5$ or $3C_5H_4O_2 - H_2O$, and its heat of combustion is 1684·2 Cal., and its heat of formation +75·3 Cal. It follows that its formation from furfuraldehyde, with elimination of water, absorbs only −4·8 Cal.

The heat of dissolution of furfuraldehyde is +0·13 Cal. at 6°, and potassium hydroxide produces no thermal disturbance when added to the solution.

In the camphenic series, it follows, from previous determinations of the heats of formation, that the oxidation of borneol to camphor, with elimination of water, develops +52·0 Cal., and the direct hydrogenation of camphor develops +17·0 Cal.

The difference between the isomeric campholenic acids, assuming that the latent heat of fusion of the solid acid is about −4 Cal., is only 6 Cal., and is of the same order and magnitude as the difference between fumaric and maleic acids (compare Béhal, this vol., i, 553). Adopting the value for the solid acid, it would follow that the oxidation of camphor to campholenic acid develops +48·8 Cal., and the oxidation of borneol, with simultaneous formation of water, +100·8 Cal. The oxidation of camphor to camphoric acid develops +170·9 Cal. or +57·0 × 3.

The hydration of camphor with formation of campholic acid develops +5·5 Cal. if the water is liquid, and +4·1 Cal. if the water is solid, the thermal disturbance being of the same order as in the conversion of glyoxal into glycollic acid.

Comparison of all the thermal measurements that bear on the relations between alcohols, phenols, aldehydes, and acids, leads to the general conclusion that the conversion of a true aldehyde into an alcohol by addition of H_2 develops from +13 to +17 Cal., the mean being about 15 Cal. in the paraffin series, whether the alcohol is monhydric or polyhydric.

From this point of view, camphor belongs to the paraffin series, a conclusion also deducible from the well-known synthesis of the hydrocarbons $C_{10}H_{16}$ from the hydrocarbons C_5H_8.

In the benzene series, the corresponding thermal disturbance is much higher, the fixation of H_2 developing +40 Cal. in the case of quinone, and +30 Cal. in the case of salicylaldehyde.

The conversion of an aldehyde into an acid by combination with O, develops from 60 to 68 Cal., except in the case of camphor, which belongs to a special group, and develops only +48·8 Cal., a result which supports Béhal's views (*loc. cit.*). Camphor, in fact, resembles glyoxal, the oxidation of which to glyoxylic acid develops +45·6, whilst the latter, when oxidised to oxalic acid, develops the normal +66·8 Cal. On the other hand, salicylaldehyde when oxidised develops +72·6 Cal., which is higher than in the case of any other aldehyde.

The conversion of an alcohol into an aldehyde as a rule develops less heat than the oxidation of an aldehyde to an acid. All the combinations with oxygen develop less heat than the oxidation of free hydrogen; but the difference would be much smaller if the heat of liquefaction of hydrogen were known, and the calculations could be referred to the same physical state. On the other hand, the combination of aldehydes with hydrogen in the paraffin series develops much less heat than the formation of water, and hence the alcohols retain a reserve of available energy which comes into play in their subsequent oxidations. C. H. B.

Cryosalts. By A. Ponsot (*Bull. Soc. Chim.*, 1895, [3], **13**, 312—316).—If the strength of a solution of an ordinary crystallisable salt is plotted against the temperature in the usual manner, the points representing its possible values fall between, and to the right of, two intersecting inclined lines, one of which rises with the temperature and represents the maximum concentrations, or states of saturation at the various temperatures, and the other which falls as the temperature rises, and represents the minimum concentrations. Points above the first line thus represent unstable states in which the solution is supersaturated with the salt, whilst those below the second line represent unstable states in which the solution is supersaturated with ice. The point of intersection, and points between the lines to the left of this, therefore represent states in which crystals either of the salt or of ice may separate from solutions of the requisite strength on cooling to the requisite temperature.

The author has verified this last deduction by microscopic examination of the crystalline products obtained by freezing solutions of coloured salts, such as potassium permanganate and dichromate, and of colourless salts affecting polarised light, such as potassium chloride and nitrate. In every case, the so-called cryohydrate was found to be a mixture of microscopic crystals of the salt and of ice, and the salts thus separated were either anhydrous, or combined with comparatively small, and molecularly simple, amounts of water.

The separation of the ice may be effected on a larger scale by freezing the solution in a test-tube, and then melting the middle part of the mass. When the liquid zone has reached nearly to the bottom, the tube is again exposed to a low temperature and shaken continuously, with the result of increasing the proportion of ice in the mass of crystals floating at the top, and by repeating the operation a sufficient number of times, ice may be obtained in any desired degree of purity.

Guthrie's cryohydrates cannot therefore be regarded as chemical individuals, and Pfaundler's views as to their nature are confirmed. The author proposes to substitute the term *cryosalt* (*cryosel*) for the older term cryohydrate, and suggests that the temperatures of formation of such salts be used as characteristic constants. Jn. W.

Cryohydrates. By Max Roloff (*Zeit. physikal. Chem.*, 1895, **17**, 325—356).—The paper contains the determinations of the composition of a number of cryohydrates of various pairs of compounds, by means of the measurement of the lowering of the freezing point of each component by varying quantities of the other, and hence obtaining the cryohydrate composition from the point of intersection of the curves, usually straight lines. The following results were so obtained:—Benzoic acid and benzene, composition 5·1 per cent. benzoic acid, freezing point −4·2°; acetic acid and benzene, 36·1 per cent. acetic acid, −8·8°; naphthalene and diphenylamine, 30·1 per cent. naphthalene, 32·45°. In the case of a mixture of naphthalene with thymol, satisfactory results were not obtained. The effect of external pressure on the composition of the cryohydrate is next considered, and the value dp/dT deduced theoretically. It is also determined experimentally by the use of the mano-cryometer (Abstr., 1893, ii, 563). The same coefficient is also obtained by making use of Thompson's formula, $dT/dp = T/J \times (\sigma - T)10333/w$, where $\sigma - T$ is the volume increment on melting (c.c. per kilo.), and w the heat of liquefaction, these constants being experimentally determined. The values obtained in the case of the mixture of naphthalene with diphenylamine were respectively 34·1, 33·2, and 32·1 atmospheres per degree centigrade. The effect of a third component is next investigated, the first experiments being on acetic acid and benzene with the addition of water. The cryohydrate minimum is thus lowered, and occurs at a higher acetic acid content than the normal, the more so the greater the water content. With vaseline—soluble in benzene, insoluble in acetic acid—the minimum is again lowered, but corresponds with a higher benzene content, the effect of naphthalene being very similar. L. M. J.

Molecular Weight Determinations in Solid Solutions. By FRITZ W. KÜSTER (*Zeit. physikal. Chem.*, 1895, **17**, 357—373).—In order to determine the molecular weight of a compound present in a solid solution, the author considers the equilibrium of β-naphthol, naphthalene, and water, in which case the two solids are non-electrolytes, the one being soluble, the other insoluble in water, and he shows experimentally that they are capable of forming a homogeneous, isomorphous mixture, a result at variance with those obtained by van Bijlerts (Abstr., 1891, 1411). The solubility of the β-naphthol for decreasing naphthalene content rises regularly to a maximum, when it suddenly falls to a constant value equal to the solubility of the pure naphthol. The ratio of the partition coefficients in water and naphthalene is not constant, but an approximately constant value is obtained for the ratio $\sqrt{K_s}/K_w$, where K_s and K_w are the concentrations of the naphthol in the solid and aqueous solutions. The molecule of the naphthol in the solid solution is hence double of what it is in the aqueous solution, that is, $2C_{10}H_8O$, the naphthalene being $2C_{10}H_8$. The complexity of the crystals of the isomorphous mixture is determined by the alteration of the solubility of the naphthol and naphtholnaphthalene. The best results for the maximum solubility are obtained on the supposition that the mixture has the complexity $xC_{10}H_8,(2-x)C_{10}H_8O$, which yields the values for the solubility 0·0775 and 0·0675 at 18° and 25·1°, the observed values being 0·0780 and 0·0682. The complexity of the molecules in the solid solution are hence respectively $2C_{10}H_8$, $2C_{10}H_8O$, and $(C_{10}H_8,C_{10}H_8O)$.

L. M. J.

History of the Periodic System. By KARL SEUBERT (*Zeit. anorg. Chem.*, 1895, **9**, 334—338).—Lother Meyer gave A. Remele, his successor at Eberswalde, in July, 1868, a paper containing a periodic arrangement of the elements; it is headed "§ 91," and evidently intended for a new edition of his '*Modernen Theorien.*' It contains 52 elements, arranged in 15 vertical series (families), instead of the 28 elements in six series given in the first edition. In Mendeléeff's first table, published in 1869, the elements in each period are arranged in vertical columns. J. B. T.

Classification of Chemical Elements. By Paul E. Lecoq de Boisbaudran (*Compt. rend.*, 1895, **120**, 1097—1103) and by Charles Friedel (*ibid.*, 1103).—In calculating the atomic weights of a hypothetical family of elements, which may form an eighth column in Mendeléeff's table (this vol., ii, 257), the author considered only the elements with atomic weights above 20, and regarded the elements which usually appear in the eighth column as not belonging to the same family at all. The classification, however, indicates the possible existence of an element below the element 20·1, with an atomic weight of about 3·9, and an element in the chlorine family below fluorine, with an atomic weight of about 2·9.

Ramsay's determination of the sp. gr. of helium gives 3·88, and hence the specific gravities of argon and helium respectively agree with the numbers which the author predicted as the atomic weights of hypothetical elements, with which they seem to correspond.

In each well-established natural family of elements, there is one which seems to possess in a special degree the properties characteristic of the family, and of which it may be regarded as forming the centre or *node*. These elements are Ca, K, (δ), Cl, S, P, Si, Al, and if they are placed in line, the line is the higher limit of the atomic weights which increase by increments of about 16, and the lower limit of the atomic weights which increase by larger increments, such as 48. The higher groups of three attached to these elements (*e.g.*, Ca, Sr, Ba, or Cl, Br, I) are all comparable amongst themselves from both a chemical and a spectroscopic point of view, and their variations, or, in other words, the differences between the first increase of about 48 and the second, are comprised within very narrow limits. If any other elements are taken as the nodes, these relations do not hold good. With the arrangement proposed by the author, the atomic weight of one node can be calculated from the atomic weights of the others, and comparison of the variations enabled the author to calculate accurately the atomic weights of gallium and germanium. The table on this basis is—

					(? η)″	Bi′	Pb″	Tl′
	Ba″	Cs′	(? ζ)″	I′	Te″	Sb′	Sn″	In′
	Sr″	Rb′	(? ε)″	Br′	Se″	As′	Ge″	Ga′
Nodes	Ca″	K′	(? δ)″	Cl′	S″	P′	Si″	Al′
	Mg″	Na′	(? γ)″	F′	O″	N′	C″	B′
	Be″	Li′	(? β)″	(? α)′.				
	H	H	H	H	H	H	H	H

All the groups contain the same number of elements. Where the atomic weight of the node is more than 32, there are two elements between it and hydrogen, but where it is less than 32 there is only one element between the node and hydrogen. In the latter cases, however, there is an additional element above the higher group of three [(η), Bi, Pb, Tl]. Starting from hydrogen, each family is formed by five successive increments, and it would seem that hydrogen itself has been formed by addition to some element of still lower atomic weight, or that hydrogen and the seven other elements of small atomic weight on the same line have been formed by addition to eight others on a still lower line.

In the table, elements of odd and even quantivalence alternate. The electro-negative elements are in the middle, and the relatively strongly electro-positive elements are at the extremities. In the case of both metals and non-metals, that element of each pair which has the lower atomic weight has odd quantivalence.

If it is supposed that a mass of primordial matter A is, by some cause, divided into two unequal parts, two elements belonging to the same horizon will be produced, $A/2 + q$ and $A/2 - q$, the one being electro-positive with respect to the other. A repetition of the process will result in four elements, two electro-positive and two electro-negative, and so on. If it is assumed that eight elements are formed in this way, they might give rise by successive additions, or subtractions, to the eight families included in the table, and the additions or subtractions would correspond with variations in properties in both a horizontal and a vertical direction. It is obvious that, on this hypothesis, there must be an even number of families. From this point of view, the formation of chemical elements depends on inequalities between masses of matter, just as forces result from inequalities in the motions of bodies, and in both cases there is compensation between the masses (or movements) of opposite sign round about a state of equilibrium which is never re-established after it has once been disturbed. It may be that the material inequalities, whilst retaining a constant sum, are continually undergoing modifications.

By means of empirical relations, the author has calculated the atomic weights of the first elements in the vertical columns from the atomic weight of hydrogen, with a view to obtain their absolute values. One of these relations leads to the following values.

	H = 1.	O = 16.		H = 1.	O = 16.
Beryllium.	9·0156250	9·05098	Oxygen.	15·9375000	16·00000
Lithium ..	6·9921875	7·01961	Nitrogen	13·9843750	14·03922
(? β)	3·8906250	3·90588	Carbon .	11·9453125	11·99216
(? α)	2·9375000	2·94902	Boron ..	10·9218750	10·96471

Friedel states that, several days before April 22, Boisbaudran spoke of 20 and 3·9 as the probable atomic weights of argon and helium respectively.

C. H. B.

The Colour of Atoms, Ions, and Molecules. By M. Carey Lea (*Zeit. anorg. Chem.*, 1895, **9**, 312—328; also *Amer. J. Sci.*, **49**, 357—374).—When the elements are divided into two series, one containing those elements whose atoms show colour in combination, the other containing those elements whose atoms in certain cases, or in all cases, show no colour, it is seen that this classification corresponds in a remarkable degree with the chemical properties of the elements.

It has been shown by Ewan that a solution of copper sulphate containing 2·38 gram-equivalents per litre, in which the dissociation amounts to 15·3 per cent., has almost the same absorption for light as a solution containing 0·2856 gram-equivalent per litre, in which the dissociation amounts to 31·7 per cent. Therefore, the colour is not due to the free ions or to the molecules, and must be due to the atoms, whether they be present as ions or combined with another ion to form an electrolyte. Thus, in dilute solutions of cobalt salts, the ions show the characteristic colour of cobalt, and cobalt cyanide which contains no water also shows the same colour. The same is true of nickel cyanide.

In an electrolyte which gives a colourless solution in water, both the cathion and anion are colourless. Thus, lithium bromide, which gives a colourless solution, contains the colourless ions of lithium and bromine. There is no connection between the colour of an atom and the colour of the element formed by a combination of atoms; thus the colourless bromine atom forms the intensely coloured element bromine. The colourless nature of the bromine atom may be inferred from the fact that all its compounds with the alkalis and alkaline earths are colourless. In an electrolyte which gives a coloured solution in water, when the anion is a single atom, the colour is due to the cathion, for all elementary anions are colourless. Even if the anion is a complex one, such as SO_4, and is colourless, the colour of a solution of an electrolyte containing this anion is to be referred to the cathion.

The colour, or want of colour, of the atom of an element is a function of its atomic weight. Elements with atomic weights up to 47 have only colourless ions; then follow eight elements, Ti, V, Cr, Mn, Fe, Co, Ni, Cu with coloured ions; nine elements, Zn, Ga, Ge, As, Se, Br, Rb, Sr, Yt with colourless ions; six metals, Nb, Mo, Ru, Rh, Pd, Ag with coloured ions; nine metals, Cd, In, Sn, Sb, Te, I, Cs, Ba, La with colourless ions; ten metals, Ce, Di, Sm, Er, Ta, W, Os, Ir, Pt, Au with coloured ions; and finally the six metals, Hg colourless, Tl coloured, Pb colourless, Bi coloured, Th colourless, and U coloured.

The author has arranged the elements in a periodic system, on the basis that no element which in all its combinations shows coloured ions can be combined in the same natural group with elements which have colourless ions.

The elements which have colourless ions can be arranged in nine horizontal groups, in which each element falls naturally into its proper place. This division of the elements contains all those whose ions can act as anions. Elements which have only coloured ions can be arranged similarly in five vertical series, the last series containing only the element uranium. This division contains elements whose ions can act only as cathions. There remain eleven elements, Ti, V, Cu, Nb, Mo, Ag, Ce, Ta, W, Tl, Bi, whose ions are in some cases coloured, in others colourless. In the whole series of all the elements, these elements come between a group of elements which have colourless ions and one of elements which have coloured ions. There is no case in which an element with only colourless atoms falls in the periodic series between one of these eleven elements and an element with only coloured atoms. And also an element with only coloured atoms never comes between one of these eleven elements and one with only colourless atoms.

The conclusion is that the colour of the elementary atoms is a function of the atomic weight. Atoms with the atomic weight 1—47 are colourless, 52—59 coloured, 65—90 colourless, 103—106 coloured, 112—139 colourless, 145—169 coloured, 192—196 colourless. Elements which have atomic weights which lie between these groups have both colourless and coloured atoms. E. C. R.

Inorganic Chemistry.

Composition of Atmospheres which Extinguish Flame. By FRANK CLOWES (*Proc. Roy. Soc.*, 1894, **56**, 2—6).—The experimental flame burning at a platinum jet 1 mm. in diameter, was 0·75 in. in height; it was gradually lowered into a cylinder containing the atmosphere of mixed gases, and these were considered to be in extinctive proportions if the flame was extinguished during its downward passage, or immediately on attaining its lowest position in the cylinder. The gaseous mixture was regarded as containing the minimum quantity of extinctive gas, when the flame on being lowered into another mixture containing 1 per cent. less of such gas continued to burn in it for a few seconds before being extinguished. Experiments made with flames of hydrogen and alcohol, varying from 0·4 in. to 1·5 in. in height, show that the varying dimensions of the flame are without influence on the proportion of carbonic anhydride in the air necessary to produce extinction. Characteristic differences were observed between the behaviour of wick-fed flames and that of gas-fed flames when they were introduced into an atmosphere which extinguished them, the wick-fed flames gradually diminishing in size until they vanished, whilst the gas-fed flames gradually increased in size, becoming paler and apparently lower in temperature until they suddenly expired.

The results of the experiments, of which a table is given in the original paper, show (1) that the extinction of a flame is not determined simply by the proportion which the inert gas bears to the oxygen of the atmosphere into which it is introduced, but that the nature of the inert gas present also influences the result. (2) Carbonic anhydride exerts a more powerful extinctive effect on flame than nitrogen does. (3) There is a remarkable uniformity in the proportions of inert gas, which must be mixed with air in order to just extinguish wick-fed flames; but this uniformity does not apply to the flames of combustible gases burnt from a jet. (4) The flames of gases burnt from a jet show no simple relation, as regards the proportion of oxygen present in the extinctive atmosphere, to the relative proportions of oxygen required for their complete combustion. In the presence of the hydrogen flame carbonic anhydride does not suffer partial deoxidation.

The introduction of a minimum of 15 per cent. of carbonic anhydride into air is necessary to cause it to extinguish ordinary wick-fed flames. For the extinction of coal-gas flames, however, the addition of 33 per cent. of carbonic anhydride is necessary, and for the hydrogen flame 58 per cent. E. C. R.

Preparation of Perchloric acid and its Use in the Estimation of Potassium. By D. ALBERT KREIDER (*Zeit. anorg. Chem.*, 1895, **9**, 342—348).—Sodium chlorate is converted into perchlorate by cautiously heating during 1½—2 hours, the residue being dissolved in water, and hydrochloric acid added in quantity sufficient to decompose any unaltered chlorate; the solution is then evaporated to dryness, stirring vigorously towards the end of the operation, as otherwise the perchlorate retains some water and solidifies so that it cannot be removed from the dish. The finely pulverised residue is treated with concentrated hydrochloric acid, filtered from the sodium chloride, and well washed with hydrochloric acid, which is then removed from the solution by evaporation. The perchloric acid is sufficiently pure for the determination of potassium, for the slight residue obtained when it is evaporated is completely soluble in alcohol (97 per cent.), and consists of sodium perchlorate. If the sodium chlorate contained potassium chlorate the pulverised crystals of chloride and perchlorate are treated with alcohol (97 per cent.), which dissolves the latter more readily than the former, the alcohol is removed, and the residue treated with hydrochloric acid as above. The solubility of sodium perchlorate in alcohol (97 per cent.) is 0·2 gram per c.c. The preparation of perchloric acid, including the separation of the potassium salts, occupies about two days; 100—300 grams of sodium chlorate may be conveniently employed. For the estimation of potassium, the substance, which must be free from sulphuric acid, is dissolved in hot water (20 c.c.), perchloric acid (1·5 times the theoretical quantity) added, and the solution evaporated to a syrup, stirring constantly. It is then again dissolved in water and evaporated, the residue being washed twice with about 20 c.c. of 97 per cent. alcohol containing 0·2 per cent. of perchloric acid, the alcohol is decanted through an asbestos filter, the crystals dissolved in hot water (10 c.c.) containing a little perchloric acid, and the solution again evaporated to dryness; the residue is finally washed on to the filter with the smallest possible quantity of the alcoholic perchloric acid, treated once with pure alcohol, dried at 130°, and weighed. The alcoholic washings should not exceed 50—70 c.c. The removal of phosphoric acid is unnecessary, but if it is present the potassium perchlorate should remain in contact with perchloric acid. in excess, before treating with alcohol. The analytical results are satisfactory. J. B. T.

Density of Nitrogen. By LORD RAYLEIGH (*Proc. Roy. Soc.*, 1894, **55**, 340—344).—In a previous paper (*Proc. Roy. Soc.*, **53**, 146), the author has shown that nitrogen prepared by Lupton's method is lighter, by about 1/1000 part, than that derived from air in the usual way. It is now shown that nitrogen derived entirely from chemical compounds is materially lighter than atmospheric nitrogen. This difference amounts to about 1/200 part of the whole.

	Mean density.
Nitrogen from nitric oxide by hot iron..........	2·30008
Nitrogen from nitrous oxide by hot iron	2·29904
Nitrogen from ammonium nitrite by hot iron	2·29869
Atmospheric nitrogen by hot copper (1892)......	2·31026
Atmospheric nitrogen by hot iron (1893)........	2·31003
Atmospheric nitrogen by ferrous hydrate (1894)..	2·31020

Experiments have proved that the densities do not alter when the gas is exposed to the silent electric discharge. The author demonstrates that the lightness of the nitrogen from chemical compounds cannot be due to the presence of impurities such as hydrogen, ammonia, water vapour, &c. J. J. S.

Reduction of Nitric Oxide by Moist Iron or Zinc. By PAUL SABATIER and J. B. SENDERENS (*Compt. rend.*, 1895, **120**, 1158—1161).—Nitric oxide in contact with moist zinc turnings over water is at first reduced to a mixture of nitrous oxide and nitrogen with a small quantity of hydrogen. If the action is allowed to continue, the proportion of nitrous oxide diminishes, whilst that of nitrogen and hydrogen increases, the gas finally being a mixture of nitrogen and hydrogen only. The hydrogen is doubtless a result of the action of the ammonia on the zinc.

In contact with moist iron, standing over mercury, the nitric oxide is reduced to a mixture of nitrous oxide and nitrogen, in the proportion of 2 vols. of the former and 1 vol. of the latter, with a small quantity of hydrogen, which results most probably from the action of the iron on the water in presence of mercury.

The reduction of the nitric oxide takes place slowly, probably because of its slight solubility in water. A solution of the gas in ferrous sulphate solution is much more rapidly reduced, and the gas produced consists at first of 2 vols. of nitrous oxide with 1 vol. of nitrogen, but after a time the proportion of nitrous oxide diminishes and that of nitrogen increases, whilst hydrogen is also given off in gradually increasing proportion, until at the end of the action the gas is a mixture of nitrogen and hydrogen only in practically equal volumes. The iron becomes covered with hydrated ferrosoferric oxide. Similar results are obtained with zinc. C. H. B.

New Polyphosphoric Acid, $H_5P_3O_{10}$, and its Salts. By FRITZ SCHWARZ (*Zeit. anorg. Chem.*, 1895, **9**, 249—266).—Salts of tetraphosphoric acid have been described by Fleitmann and Henneberg (*Annalen*, **65**, 322), the sodium salt being obtained by melting the anhydrous pyrophosphate with hexametaphosphate. It crystallises with $36H_2O$. Fleitmann and Henneberg's acid tetraphosphate, $Na_4H_2P_4O_{13}$, is formed from the salt $Na_2H_2P_2O_7$ by the removal of the water of crystallisation.

Sodium triphosphate is best obtained by melting 100 grams of the pyrophosphate with 50—55 grams of metaphosphate; after keeping it in a fused state for about 15 minutes, it is allowed to cool slowly, and the product is broken into small pieces and cautiously dissolved in cold water. The solution, allowed to remain all night, is filtered, and the filtrate evaporated spontaneously; the crystals which are deposited can be recrystallised from cold water, but great care is necessary, as the heat developed on treating them with water is sufficient to partially convert the salt into metaphosphate. It crystallises from water with $16H_2O$ in transparent crusts, loses water on exposure to air, and is very soluble. The solution has a faintly alkaline reaction; when boiled, it is quickly converted into pyrophosphate, whilst with mineral acids and some organic acids it yields pyrophosphate in the cold, and also orthophosphate when heated with them. The solution gives no precipitate with magnesia mixture until strong ammonia is added, which converts the salt into orthophosphate. Triphosphoric acid gives precipitates with salts of the heavy metals only in very concentrated solutions, and is then only partially precipitated, whereas pyrophosphoric acid is completely precipitated by salts of the heavy metals even in dilute solutions. The reason of this characteristic behaviour of triphosphoric acid lies in the formation of double salts; these separate in well-formed crystals from concentrated solution of the sodium salt and the salt of the heavy metal. The free acid obtained from the copper salt by means of hydrogen sulphide is quickly converted, in aqueous solution, into pyrophosphoric acid, and consequently albumin is not coagulated by the solution. If, however, a few drops of acetic acid are added to a solution of the sodium salt, the triphosphoric acid in the nascent state will coagulate albumin.

Cobalt sodium triphosphate, $CoNa_3P_3O_{10} + 12H_2O$, is obtained by adding a solution of a cobalt salt to one of sodium triphosphate of such a strength that no precipitate is formed, and then evaporating the mixed solution in a vacuum; it crystallises in beautiful, lustrous, rose-red crystals, which when dehydrated turn blue, and melt at a red heat to a clear blue glass. It is insoluble in water, but easily soluble in acids, by which, however, it is not decomposed. A salt of the composition $4CoO,Na_2O,3P_2O_5$, is obtained as a rose-red precipitate on adding cobalt sulphate (1·5—1·75 grams) to sodium triphosphate (1 gram) dissolved in the smallest possible quantity of water; it contains 29—33 per cent. of water.

Nickel sodium triphosphate, $NiNa_3P_3O_{10} + 12H_2O$, obtained in a similar way to the cobalt salt, forms green crystals which turn yellow when heated, and melts at a red heat to a brown glass. These nickel and cobalt salts crystallise in rhombic prisms and are isomorphous.

Copper triphosphate, $5CuO,3P_2O_5 + 13H_2O$, is obtained by precipitating the sodium salt with copper sulphate in concentrated solution.

Lead triphosphate, $6PbO,4P_2O_5$, is obtained as a white precipitate which dissolves in an excess of the sodium salt; at a high temperature it melts to a white glass. The precipitate of this salt is always mixed with lead tetraphosphate.

Barium triphosphate and calcium triphosphate, obtained by adding barium chloride and calcium chloride respectively to the solution of the sodium salt, form thick, flocculent, white precipitates.

Zinc sodium triphosphate, $4ZnO,Na_2O,3P_2O_5 + 19H_2O$, is very similar to the cobalt and nickel salts; it is obtained from concentrated solutions as a white, crystalline powder, and from dilute solutions in beautiful, prismatic, colourless crystals. At a high temperature, it melts to a colourless glass. E. C. R.

Reduction of Silica by Aluminium. By VIGOUROUX (*Compt. rend.*, 1895, **120**, 1161—1164).—When finely powdered silica (3 mols.) and finely powdered aluminium (4 atoms), previously freed from grease, are heated together, there is brilliant incandescence, the silica is reduced, and, after successive treatments with hydrochloric, sulphuric, and hydrofluoric acids, amorphous silicon is obtained.

Crystallised silicon is obtained on heating silica and aluminium in an electric furnace. If the aluminium is in excess, the silicon dissolves in it; if the silica is in excess, the silicon forms the lower layer in the carbon crucible, or partly fuses and partly distils if the tube furnace is used. It can also be obtained in large quantity by heating a mixture of silica and aluminium with potassium silicofluoride in a carbon crucible in a Perrot furnace. By whichever method it is obtained, crystallised silicon forms thin, hexagonal lamellæ, which are sometimes very thin, and then are transparent, and have a yellow colour, but do not act on polarised light. The chemical properties of the crystallised silicon are identical with those of the amorphous variety (this vol., ii, 263). C. H. B.

A Remarkable Change of Structure in Glass when Heated. By ED. PŘIWOZNIK (*Zeit. anorg. Chem.*, 1895, **9**, 289—290).—The author describes the exfoliation which some specimens of soda glass undergo when heated.

Molecular Weight of Mercurous Chloride. By MICHELE FILETI (*Gazzetta*, 1895, **25**, i, 88—94).—A polemical paper replying to V. Meyer (this vol., ii, 46), who has already published his answer (this vol., ii, 166). W. J. P.

Crystalline Aluminium Chloride. By L. M. DENNIS (*Zeit. anorg. Chem.*, 1895, **9**, 339—341).—In order to obtain crystalline aluminium chloride, commercial anhydrous aluminium chloride is dissolved in water, and, after being filtered through glass wool, is mixed with concentrated hydrochloric acid, and the solution, cooled with a freezing mixture, is saturated with dry hydrogen chloride. The crystals which rapidly form are washed by decantation with concentrated hydrochloric acid until free from iron, and the excess of acid is removed as far as possible by the aid of the pump. The crystals are then placed on porous tiles and exposed to the air until free from hydrogen chloride; in moist air, water is absorbed, but if kept at 20° their weight becomes constant after about 48 hours. The crystals, $AlCl_3,6H_2O$, do not change when kept over sulphuric acid, but if heated in a stream of dry hydrogen chloride, a basic salt is formed. Crystals may be obtained by adding concentrated hydrochloric acid to cold, concentrated, aluminium chloride solution, but they are very small. The larger crystals, which are fully described, consist of hexagonal prisms of the second order, bounded by rhombohedral faces, $a : c = 1 : 0·5356$; $p : r = 62° 54'$; $r : r = 54° 12'$. The refractive index = about 1·6; the double refraction is strong $\omega - \epsilon = 0·053$. J. B. T.

Preparation of Stannic Bromide. By Richard Lorenz (*Zeit. anorg. Chem.*, 1895, **9**, 365—368).—Tin, in pieces 2—3 cm. long, is placed in a distillation flask, closed at the top with a cork fitted with a separating funnel drawn out to a capillary point; the funnel is filled with bromine, which is added to the tin so slowly that the temperature remains at 35—59°, and the side tube does not become filled with bromine vapour; the action proceeds quietly. When the greater portion of the tin has disappeared, the contents of the flask are distilled; the first few drops contain a little bromine, but that which subsequently passes over is pure stannic bromide. It boils at 201°, is colourless, readily forms crystals, and fumes slightly on exposure to moist air. The bromide may be stored in a corked flask; if this is heated to about 40°, the bromide readily melts, and can be withdrawn in any desired quantity. J. B. T.

The two Modifications of Stannic acid. By Richard Lorenz (*Zeit. anorg. Chem.*, 1895, **9**, 369—381).—A historical account of the investigation of stannic acid and metastannic acid is given; the gradual and almost equal loss of water by both compounds under similar conditions is confirmed, proving that their composition is identical, and that both exist in all degrees of hydration, from H_4SnO_4 to H_2SnO_3. The compounds retain their characteristic properties after repeated precipitation from salts or solutions, and their salts differ. Recently prepared aqueous solution of stannic chloride or bromide is identical with that formed by dissolving stannic acid in hydrochloric acid or hydrobromic acid respectively. Aqueous stannic chloride solution gradually changes when kept, and the course of this change may be followed by means of potassium ferrocyanide; it consists in a progressive decrease of the tin ions. Aqueous stannic bromide solutions gradually deposit a white gelatinous precipitate, and the change which takes place in the solution appears to proceed regularly, as represented by the expression, $\frac{1}{t} \log \frac{a}{a-x} = K$ constant, where a = the tin in the stannic bromide, x = the tin in the precipitated metastannic acid, H_4SnO_4, and t = the time in minutes. The value of K found = 0·000726—0·000906, t = 1430—3890 In one case $K = 0·001071$, $t = 1010$, the difference between this value and those given above is probably due to incomplete precipitation of the metastannic acid. J. B. T.

Cerite Earths. By Paul Schutzenberger (*Compt. rend.*, 1895, **120**, 1143—1147).—The methods previously employed (this vol., ii, 352) have been extended to the nitrates remaining undecomposed in presence of excess of potassium nitrate after complete elimination of the cerium. These nitrates were fractionated by heating them at gradually increasing temperatures, and the treatment was repeated on some of the first products of the fractionation. The general result is that the curve of the atomic weights of the metals contained in the successive fractions rises from a minimum of about 135 to a maximum of 143 to 143·5, and then descends to a second minimum of about 138. The maximum atomic weight of didymium lies between 143 and 143·5. When monazite is subjected to the same treatment as cerite, the oxides which separate from the fused nitrates between 410° and 460°, after careful elimination of the cerium, form decidedly rose-coloured salts, which show the absorption bands of neodymium, and contain a metal with an atomic weight very near 137·5. There are reasons for believing that between the two limits of 143·5 and 137·5 there are other metals which have all the general properties of didymium, and in particular an element with an atomic weight of about 140.

Lanthanum oxide (as defined subsequently) can be split up into at least two oxides, the one containing a metal with an atomic weight of about 138, and the other a metal of atomic weight of about 135. As in the case of didymium, the stability of the nitrates when heated is higher the lower the atomic weight of the metal.

The author defines as *cerite earths* all the oxides which give a double potassium sulphate insoluble in a saturated solution of potassium sulphate; as *cerite oxides* all the oxides capable of conversion into a dioxide, and forming colourless salts, the solutions of which show no absorption bands; as *didymium oxides* all those which form more or less rose-coloured salts, the solutions of which show the absorption bands of didymium salts, the oxide formed at high temperatures being M_2O_3; and as *lanthanum oxides* those which form colourless deliquescent salts, with no absorption bands, and yield an oxide, M_2O_3, when strongly heated. (Compare Schutzenberger, *loc. cit.*, and Brauner, *ibid.*) C. H. B.

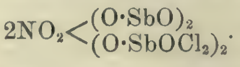
Iodine Compounds of Lead with Excess of Iodine. By HORACE L. WELLS (*Zeit. anorg. Chem.*, 1895, **9**, 304—311, and *Amer. J. Sci.*, **50**, 21—26).—The salt, $5Pb(OAc)_2,3KI,6I$, which has been prepared by Johnson (Trans., 1878, 189) by mixing a hot, concentrated, alcoholic solution of potassium triiodide with a hot, saturated solution of lead acetate, has been examined by the author. It is formed when 30 grams of potassium iodide and 50 grams of iodine dissolved in absolute alcohol are mixed with 40—100 grams of crystallised lead acetate also dissolved in alcohol, separating in crusts or groups of larger crystals, which are fairly stable when exposed to the air. The lead and potassium are determined in the salt by dissolving it in dilute nitric acid, precipitating the lead as sulphate, and estimating the potassium in the filtrate also as sulphate; the iodine is determined by treating the salt with a solution of sodium arsenite, acidifying with nitric acid, and then adding excess of silver nitrate.

The salt, $Pb_2I_5(OH)_2$, previously described by Gröger, but to which be assigned the formula Pb_2I_6O, has also been examined. It is most easily obtained by mixing a solution of 10 grams of iodine in 100 c.c. of absolute alcohol, with a solution of 50 grams of crystallised lead acetate in 150 c.c. of water, 3 c.c. of acetic acid, and 300 c.c. of absolute alcohol; after 14—16 hours, it is filtered from a slight precipitate and diluted with 1·5 litres of boiling water. On cooling, the salt crystallises out in lustrous, black octahedra, which are fairly stable when exposed to the air; it is not decomposed by cold water, or by alcohol. Using Gröger's method, the salt is obtained as a reddish-brown powder, but it has the same composition as the crystalline salt. E. C. R.

Reactions of Lead Sulphide. By Arthur Lodin (*Compt. rend.*, 1895, **120**, 1164—1167).—Lead sulphate, alone, or mixed with other substances, was heated in a glass or porcelain tube, the temperatures being measured by means of a Le Chatelier thermoelectric couple. When heated at 860° in a current of carbonic anhydride, lead sulphide volatilises to a considerable extent, and at the same time is partially oxidised; in a current of nitrogen, it volatilises completely at 860°, without previously melting. The melting point of the sulphide when rapidly heated is between 930° and 940°. Mixtures of the sulphide with the monoxide, or the sulphate, when heated in porcelain tubes in an atmosphere of nitrogen, gave results which confirm the accuracy of the ordinary equations, $PbS + 2PbO = 3Pb + SO_2$; $PbS + PbSO_4 = 2Pb + 2SO_2$; and $PbS + 3PbSO_4 = 4PbO + 4SO_2$.

Although lead sulphide only melts at 935°, it has a very considerable vapour tension even at much lower temperatures, and this fact explains not only the phenomena of volatilisation, which Hannay attributed to the formation of a hypothetical compound, PbS_2O_2 (Proc., 1894, 113 and 151), but also the interactions between the sulphide on the one hand, and the oxide or sulphate on the other, at temperatures below 935°. C. H. B.

Action of Nitric Peroxide on Antimony Salts. By Vincent Thomas (*Compt. rend.*, 1895, **120**, 1115—1117).—The action of nitric peroxide on a solution of antimony trichloride in chloroform yields a white, somewhat stable, compound of the composition $Sb_4O_{11}N_2Cl_4$, probably $2SbO_2, 2SbOCl_2, N_2O_5$, or



$$2NO_2 < \begin{matrix} (O{\cdot}SbO)_2 \\ (O{\cdot}SbOCl_2)_2 \end{matrix}.$$

Antimony tribromide, under the same conditions, yields the white compound, $Sb_4O_{15}N_4$ or $N_2O_5, 2Sb_2O_5$, analogous to the compound $2Sb_2O_3, N_2O_5$, obtained by Peligot by the combination of nitric and antimonious anhydrides. C. H. B.

Salts of Amidochromic acid. By Alfred Werner and A. Klein (*Zeit. anorg. Chem.*, 1895, **9**, 291—294).—The authors have endeavoured to prepare potassium amidochromate, $KCrO_3NH_2$, and the compound, $Cr_2O_3H_2N$, described by Heintze (*J. pr. Chem.*, **4**, 216), as obtained by the action of dry ammonia on potassium chlorochromate. The authors, however, following strictly the conditions laid down by

Heintze, obtained nothing but potassium dichromate, and they were not more successful when they modified his method. E. C. R.

Conductivity of Permanganic acid. By JOH. M. LOVÉN (*Zeit. physikal Chem.*, 1895, **17**, 374—376).—Owing to the publication of work by Franke on the conductivity of permanganic acid, the author claims priority of determination and publication. The values for the conductivity given increase from 315 at $V = 2$ to 378 at $V = 256$, after which it remains constant; the value at infinite dilution given by Franke was 383·8. The numbers are in general higher than those of Franke, this being attributed to the precautions taken by the author to prevent the decomposition of the acid by the platinum black. L. M. J.

Nitroso-compounds of Iron. By KARL A. HOFMANN and O. F. WIEDE (*Zeit. anorg. Chem.*, 1895, **9**, 295—303).—The authors have already described salts of dinitrosoferrothiosulphonic acid (this vol., ii, 317), and the method by which they can be prepared; other salts have now been obtained. The *rubidium salt*, $Fe(NO)_2S_2O_3Rb + H_2O$, obtained by adding rubidium chloride to a solution of the sodium salt, crystallises in lustrous, black needles, and is less soluble than the sodium salt. The *cæsium salt* crystallises without water in lustrous, black crystals, and is sparingly soluble. The authors were unable to obtain a thallium salt corresponding with the preceding; this non-formation of a thallium salt affords a characteristic distinction between dinitrosoferrothiosulphonic acid and heptanitrosoferrothiosulphonic acid, the latter yielding a very characteristic thallium salt of the composition $Fe_4(NO)_7S_3Tl$.

The thio-group in dinitrosoferrothiosulphonic acid is very easily eliminated, and, when a solution of the sodium salt is boiled as long as gas is evolved, the sodium salt of the hepta-acid is formed; this crystallises in needles, and may be characterised by converting it into the thallium salt. *Cæsium heptanitrosoferrothiosulphonic acid*, $Fe_4(NO)_7S_3Cs,H_2O$, obtained by adding cæsium chloride to a solution of the sodium salt, separates as a black, crystalline powder, and is very sparingly soluble. The *rubidium salt* with $1H_2O$ is obtained as a black, crystalline powder.

The *ammonium salt*, $Fe_4(NO)_7S_3(NH_4),H_2O$, is obtained by passing nitrous oxide into freshly precipitated ferrous sulphide suspended in water, or into a mixture of ferrous hydroxide, ferrous sulphate, and carbon bisulphide saturated with ammonia, and also by passing the gas into a mixture of ferrous hydroxide and carbon bisulphide. The salt, extracted from the product of the action by hot alcohol, crystallises in lustrous, black needles; when distilled with soda, it yields more than the theoretical quantity of ammonia, because some of the nitrous oxide is also converted into ammonia. Heptanitrosoferrothiosulphonic acid is easily detected by converting it into the characteristic cæsium salt.

The *compound*, $Fe(NO)_2SEt$, is obtained by treating a mixture of ferrous sulphate, potassium hydroxide, water, and ethylic mercaptan with nitrous oxide; it crystallises from absolute alcohol in large, lustrous, black, six-sided plates, has no odour, melts at 78° to a brownish-black liquid, is volatile at higher temperatures, and is insoluble in water. Determinations of the molecular weight gave numbers varying from 341 to 356, whilst the formula, $[Fe(NO)_2SEt]_2$, = 354.

Dinitrosoferrophenyl mercaptide, $Fe(NO)_2SPh$, is obtained, together with a large quantity of phenylic bisulphide, when a mixture of ferrous sulphate, potassium hydroxide, water, and thiophenol is treated with nitrous oxide. It crystallises from benzene in lustrous, black leaflets, and melts at 179°. The two preceding compounds are very stable.

E. C. R.

Physiological Chemistry.

The Output of Carbonic acid and Temperature. By MARCUS S. PEMBREY (*J. Physiol.*, 1895, 363—379). **Heat Regulation in Hybernating Animals.** By MARCUS S. PEMBREY and W. HALE WHITE (*Proc. Physiol. Soc.*, 1895, 35—37).—Further details and full account of experiments similar to those already published in preliminary communications (compare this vol., ii, 51).

W. D. H.

An Ideal Circulating Fluid for the Isolated Frog's Heart. By F. S. LOCKE (*J. Physiol.*, 1895, **18**, 332—333).—An ideal fluid for this purpose must, according to Albanese (*Arch. exp. Path. Pharm.*, **32**, 297), possess (1) isotony with frog's blood; (2) a certain amount of viscosity; (3) a degree of alkalinity sufficient to remove the acid products of metabolism; and (4) a supply of free oxygen. These conditions are all fulfilled by a solution containing 0·6 per cent. of sodium chloride, 2 per cent. of ordinary gum arabic, and a trace of sodium carbonate and kept saturated with oxygen by passing a stream of the gas through it. Gum arabic contains the potassium, magnesium, and calcium salts of arabic and similar acids; the potassium and calcium present appear to be necessary, as Ringer has stated, although denied by the Strassburg school.

W. D. H.

Comparative Digestibility of Sugar Beet, Mangel Wurzel, and Distillery Roots. By PAUL GAY (*Ann. Agron.*, 1895, **21**, 145—171).—Experiments were made in which a sheep was fed for three successive periods of two weeks each with lucerne (0·5 kilo.), oats (0·25 kilo.), together with mangel wurzel (3 kilos.), distillery roots (1·953 kilos.), and sugar beet (1·648 kilos.) respectively. The different amounts of the three roots represent the same amounts of dry matter. The actual amounts of food constituents consumed and the composition and amounts of excrement were determined, and from the results the amounts digested were calculated. The following table gives the coefficients of digestibility of the three roots, (1) mangel wurzel, (2) distillery roots, (3) sugar beets, and their nutritive relation.

	Total.	Coefficients of digestibility.					Nutritive relation.
		Proteïn.	Ether extract.	Nitrogen free extract.	Cellulose.	Ash.	
1	72·94	77·03	55·64	82·81	56·55	35·14	1/4·4
2	76·68	77·14	71·49	86·07	52·53	38·19	1/11·3
3	73·56	74·27	67·95	82·41	52·45	40·04	1/11·9

The results show clearly the superiority of distillery roots over both sugar beet and mangel wurzel. This rather unexpected result is explained by a consideration of the absolute and relative digestibilities, which depend respectively on the natural diffusibility of the food constituents, and on the relation between the proteïds on the one hand and the ethereal extract and nitrogen free extract on the other. The mean digestibility, a judicious combination of absolute and relative digestibility, gives the probable nutritive value of a food (compare Dehérain, Abstr., 1891, 493, and *Ann. Agron.*, 1892, **18**, 380). N. H. J. M.

Mycological Processes in the Intestines. By VINCENT D. HARRIS (*J. Pathol. and Bacteriol.*, 1895, **3**, 310—321).—The numerous species of bacteria met with in the intestines fall into two main groups: (*a*) those *of* the intestine, and (*b*) those *in* the intestine, whose presence is more or less accidental. Those in the first class are comparatively few in number. The chief of these which were isolated are described, and their chemical action investigated. Of the 20 species examined, only six produced indole in the test time of 24 hours; of these, four belong to the *B. coli communis* class. In no case was leucine or tyrosine obtainable from the nutrient material. The precipitation of the caseïnogen of milk is a fairly common action; much commoner than a conversion of caseïnogen into caseïn. In one case, the caseïnogen was converted into a soluble proteïd (proteose or peptone) without any preliminary curdling or precipitation. Although so many of the bacteria isolated grow readily on potato, very few of the intestinal bacteria can convert starch into sugar; the process on the potato probably stops at the dextrin stage. The inversion of cane sugar was only found to occur with one variety; a more frequent action on cane sugar appears to be the formation of lactic acid, and probably of butyric acid too. The formation of peptone and the hydrolysis of fats are extremely rare mycological actions in the intestines. W. D. H.

Feeding with Grain. By O. BÖTTCHER (*Bied. Centr.*, 1895, **24**, 377—382).—The money-values of the digestible food units of a number of grains and cattle foods are calculated from their percentage composition, and the relative money-values of proteïn, fat, and carbohydrates, which are at present (Emmerling) as 3 : 3 : 1. The results show that even with the present low prices of grain, a food unit is considerably dearer in the form of grain than in the ordinary commercial foods. Moreover, owing to the comparatively low percentage of proteïn and fat in grains, they could not be employed as substitutes for the commercial foods without waste of carbohydrates.

In a wet season, when much grain is spoilt, the good should be carefully separated, and the damaged grain given to cattle after being steamed, or else treated with 2 per cent. sulphuric acid (Maercker) to destroy injurious fungi. In feeding such grain, only small amounts should be given in conjunction with hay, roots, &c.; proteïds may advantageously be added in the form of earth nut or cotton meal, or, still better, meat meal. Meat meal is not, as sometimes supposed, injurious to the health of cattle or to the quality of the meat, or even to that of the milk and butter, if given in small quantities (0·75 kilo.). N. H. J. M.

Absorption and Metabolism in Obstruction of the Pancreatic Duct. By VAUGHAN HARLEY (*J. Pathol. and Bacteriol.*, 1895, **3**, 245—258).—Obstruction of the pancreatic duct in man, like the partial extirpation of the gland in animals, gives rise to no glycosuria, and in the present paper a comparison of a case of this condition in man, with that produced in dogs in which the organ has been wholly or partly extirpated, shows that the alterations in metabolism correspond. There is a greatly diminished absorption of the fat given in the food, and at the same time proteïd absorption is also greatly lessened. Excess of food must be therefore given, otherwise emaciation occurs. Tables of analyses accompany the paper.

W. D. H.

Synthesised Colloïds and Coagulation. By JOHN W. PICKERING and WILLIAM D. HALLIBURTON (*J. Physiol.*, 1895, **18**, 285—305; compare Abstr., this vol., i, 484).—This paper deals especially with the physiological effect of these substances when injected intravenously. The main effect in rabbits, dogs, cats, guinea pigs, and rats resembles that of nucleo-proteïds producing extensive intravascular coagulation. They do not apparently (like snake poison) cause destruction to the endothelial lining of the vascular wall, neither are they destructive to blood corpuscles. The resemblance of their action to that of nucleo-proteïds is borne out even in minor points, such as that they do not cause clotting in the intravascular blood of albino rabbits; in dogs small doses induce a "negative phase." They kill apparently by their action on the respiratory centre. It is suggested that the action of these materials is to be explained partly by their colloïd nature, but more particularly by their containing an intramolecular group of the amido-fatty series in a high state of condensation. The similar action of nucleo-proteïds is probably to be explained in the same way. W. D. H.

Neurine in Blood. By FRANCESCO MARINO-ZUCO and C. MARTINI (*Gazzetta*, 1895, **25**, i, 101—104).—Owing to the ease with which lecithin decomposes, no positive proof has yet been given of the existence of neurine as such in arterial blood; the authors have, however, devised a method by which the neurine and lecithin may be separated from blood under conditions which render it impossible that the neurine could result from the decomposition of the lecithin during the process employed.

About 3 litres of ox blood, freshly drawn from the jugular, are well agitated with a mixture (6 litres) of alcohol and ether (1 : 2); the alcoholic liquid is then treated with excess of an ethereal acid solution of platinic chloride, and water added until the ether separates. The latter is then drawn off, and the aqueous liquid repeatedly extracted with ether; the united ethereal solutions contain the lecithin whilst the aqueous liquor contains the neurine platinochloride; since no phosphoric acid can be detected in the aqueous solution, it follows that the neurine does not occur as a decomposition product of the lecithin. After precipitating the platinum as sulphide, heating the filtered liquor with precipitated lead oxide, and separating the lead as sulphide, a syrup is obtained from which neurine may be isolated as the aurochloride. W. J. P.

Proteoses in Serous Effusions. By William D. Halliburton and P. C. Colls (*J. Pathol. and Bacteriol.*, 1895, **3**, 295—299).—In searching for proteose or peptone in such fluids as blood, milk, and serous effusions, it is important to use such methods as will not in themselves lead to the formation of these hydration products from the native proteïds present. Of the methods described, boiling after acidification to coagulate the native proteïds is the least trustworthy, as it leads to the formation of these proteolytic products. Devoto's modification of the ammonium sulphate method also is not free from this source of error. The methods which give good results are those in which either alcohol or trichloracetic acid is used as the agent for coagulating the native proteïds. The trichloracetic acid method possesses the advantage of being rapidly performed, although in the investigation of solid organs like the spleen, kidney, &c., the use of alcohol is preferable. The present experiments support previous conclusions that serous effusions (like the blood from which they originate) are free from proteoses and peptone. Gillespie's (this vol., ii, 81) conclusion to the contrary is due to his having employed untrustworthy methods. W. D. H.

Elimination of Magnesium Compounds in cases of Rachitis. By William Oechsner de Coninck (*Compt. rend.*, 1895, **120**, 1180—1181).—The proportion of magnesium compounds eliminated in the urine of children suffering from rachitis is very low. The urine contains a high proportion of various pigments which adhere very strongly to the precipitated salts obtained in the course of analysis, and offer considerable resistance to incineration. C. H. B.

Action of Distilled Water on Animal Organisms. By F. S. Locke (*J. Physiol.*, 1895, **18**, 319—331).—The poisonous action of distilled water on organisms has been again recently described by Ringer and Phear (this vol., ii, 239). In the present research the same animals, tadpoles and tubifex, were employed, and although the same results were obtained with ordinary distilled water, the interpretation of these is different. Water distilled in glass has no such deleterious action, and the work of Nägeli points to traces of compounds of one or more of the heavy metals in distilled water allowed to come into contact with these. This he terms an "oligodynamic" property. Water distilled in glass becomes poisonous to life if placed in contact with a strip of metallic copper or brass. Metallic zinc is not so deleterious, and the results with lead were not quite so certain. This "oligodynamic" property can be neutralised by certain agencies, among which is the bringing of insoluble substances offering a large surface into contact with the water, or the dissolving of colloïds in it. It is possible that the beneficial action of insoluble magnetic oxide of iron and tricalcium phosphate observed by Ringer and Phear is to be explained in this way, and possibly some of the crystalloïd substances they employed similarly precipitate the noxious substance from the water. W. D. H.

Physiological Action of Toluylenediamine. By WILLIAM HUNTER (*J. Pathol. and Bacteriol.*, 1895, **3**, 259—294).—This contribution to the pathology of jaundice includes a review of previous work on the subject. The experiments recorded show that the concentration of the bile, so marked a feature of the action of the poison, is due to extensive catarrh of the bile ducts, extending from their origin downwards to the duodenum, occasioned by the excretion of the poison or its derivatives through the bile. This increase of catarrhal mucus finally arrests the flow of bile altogether. The inflammation in the duodenum itself is not regarded as essential. There is definite evidence that the drug appears in the bile an hour after its injection; by the fourth hour it is present in appreciable quantity; the special irritant action is, however, probably due rather to the derivatives of the drug. There are also changes in the blood of a destructive nature, the relationship of which to the jaundice is discussed at length. W. D. H.

Analysis of the Bone of a Mummy. By THEZARD (*Compt. rend.*, 1895, **120**, 1126—1128).—A very white, porous, and very brittle tibia of an adult human mummy from an Egyptian tomb of unknown age had the following composition:—Organic matter 24·031; P_2O_5, 24·700; CaO, 33·380; MgO, 0·762; K_2O, 0·126; Na_2O, 1·145; Fe_2O_3, 0·240; Al_2O_3, 0·534; SiO_2, 0·800; CO_2, 4·530; SO_3, 0·264; N_2O_5, 0·551; Cl, 0·709; F, traces; moisture, 7·900 = 99·672. The organic matter contained 3·163 of nitrogen, corresponding with 19·769 of proteïds, 0·850 of fatty matter, and 3·412 of other organic substances, including a small quantity of a substance which gave the reactions for cellulose. Of the phosphoric anhydride, 2·644 was soluble in ammonium citrate, and 18·160 in acetic acid.

C. H. B.

Phosphorus in Oysters. By G. ADOLPHE CHATIN and ACHILLE MÜNTZ (*Compt. rend.*, 1895, **120**, 1095—1097).—The authors have previously found (this vol., ii, 279) that the shells of oysters, and especially Portuguese oysters (*Gryphea angulata*), contain a considerable proportion of phosphorus. Further analyses give 0·038 per cent.

of phosphoric anhydride in the case of French oysters (*Ostrea edulis*) from Sables d'Olonne, and 0·089 per cent. in the case of Portuguese oysters from the beds at Oléron. Analyses of the two kinds of shells, which had been kept in the same bed for a year, gave 0·060 for the French and 0·118 for the Portuguese.

The bodies of the oysters themselves also contain considerable quantities of phosphorus, the proportion of phosphoric anhydride per 100 parts of dry organic matter being 1·836 in the case of the French and 2·052 in the case of the Portuguese oyster. Since the average weight of the flesh of the French oyster is 1·110 grams when dried, and of the Portuguese 1·157 grams, it follows that an average French oyster contains organic phosphorus equivalent to 0·020 gram of phosphoric anhydride, and the average Portuguese oyster, phosphorus equivalent to 0·032 gram. C. H. B.

Chemistry of Vegetable Physiology and Agriculture.

Effect of Calcium and Magnesium on the Development of the Organised Structures of the Cell. By Thomas Bokorny (*Ann. Agron.*, 1895, **21**, 350—352; from *Bot. Centr.*, **62**, 1).—Different algæ were kept for six weeks in nutritive solutions with and without calcium and magnesium, the solutions being contained in aluminium cups. The simultaneous absence of calcium and magnesium caused a diminution of the "chlorophyllean apparatus," and also a great diminution or even disappearance of the nucleus; the absence of calcium alone caused a diminution of the chlorophyllean apparatus; whilst when magnesium alone was omitted the result was less decided, but there was a contraction of the nucleus. Loew's theory that the chlorophyllean apparatus is a compound of calcium and nucleïn would explain the results obtained without calcium, and also the contraction of the nucleus.

Absence of potassium also gives rise to the diminution of chlorophyll bands, but that is due to the fact that without potassium there is no carbon assimilation; carbon assimilation and starch formation can take place in absence of calcium, which is only indirectly necessary to the function of chlorophyll. N. H. J. M.

Physiology of the Trichophytons. By Leslie Roberts (*J. Pathol. and Bacteriol.*, 1895, **3**, 300—309).—The examination of several varieties of fungus which occur in ringworm and allied conditions shows that their distinguishing feature is their ability to digest horny tissues, probably by means of a ferment. This *keratolytic* group includes *Favus*, the various kinds of *Trichophytons*, some *Aspergilli*, and probably others not yet identified. There are at least two natural distinctions observable in the purely trichophytic fungi, namely, a kind that digests both the cuticle and cortical substance of the hair simultaneously, and a variety that digests the cortical substance, leaving the cuticle unaffected, or attacking it at a later period. W. D. H.

Action of Calcium and Potassium Salts on the Herbage of Meadows. By Émile Mer (*Ann. Agron.*, 1895, **21**, 270—289).—The object of the author's experiments was the improvement of the peaty soils of the Vosges; his conclusions only apply to those soils. The pastures of the Upper Vosges, where the soil is a humous sand (containing 0·4 to 0·6 per cent. of nitrogen) are only benefited by the application of wood-ash (1200 kilos. per hectare), in very wet seasons; they require nitrogenous manure as well. In the case of peaty soils (nitrogen 0·6 to 1·2 per cent.), such an application of wood-ash is very effective, whilst without wood-ash they are sterile. Other peaty soils containing still more organic matter (nitrogen over 1·2 per cent.) require more wood-ash, and it may be preferable to burn the surface before applying the manure. The differences in the action of wood-ash seem to be due to the difference in the proportion of humus. It is suggested that nitrification may be more difficult in the soils containing less than 0·6 per cent. of nitrogen, and that such soils should receive an application of organic manure until they contain 0·8 to 1·0 per cent. of nitrogen, in order to make the calcium and potassium salts effective.

The applications of marl or soil which are considered necessary for peaty soils are expensive and unnecessary; all that is required is to neutralise the surface soil to the depth of a few centimetres, and to apply yearly the necessary manure. The peaty soils (with over 1·2 per cent. of nitrogen) and the marshes in France, hitherto considered useless, require to be investigated, on account of the large amount of humus they contain. N. H. J. M.

Manuring Natural Meadows. By Ed. Zacharewicz (*Ann. Agron.*, 1895, **21**, 181—184).—In order to ascertain the best form of manure for meadow land, so as to obtain the greatest yield without injuring the quality of the herbage, an eight-year old meadow rich in nitrogen and moderately rich in potash and phosphoric acid, was divided into five parts and manured as follows. (1) Farmyard manure (20,000 kilos. per hectare); (2) complete artificial manure, (sodium nitrate 150 kilos., potassium chloride 150 kilos., superphosphate 500 kilos., and gypsum 400 kilos. per hectare); (3) superphosphate (500 kilos.) alone; (4) liquid manure; and (5) unmanured. There were three crops, giving the following total amounts. (1) 10,340, (2) 11,657, (3) 10,234, (4) 8,523, and (5) 8,081 kilos. Comparing the results obtained with the various manures and the cost of the manures with that of the unmanured plot, it is shown that the complete artificial manure was the most effective, superphosphate next, whilst with both farmyard and liquid manures there was less profit than with the unmanured plot.

N. H. J. M.

Drainage from Cultivated Land. By Pierre P. Dehérain (*Ann. Agron.*, 1895, **21**, 193—207; compare Abstr., 1894, ii, 291, and this vol., ii, 133).—*Results obtained March*, 1894, *to March*, 1895.—The rainfall of the year was below the average, being high during the growing period, and low in the autumn and winter months. The amounts of nitric nitrogen in the drainage from the fallow cases was much less than was expected, and this can only be accounted for on the assumption that a large proportion of nitrates formed was taken up by cryptogamic vegetation. Stirring the soil gave a distinct increase of nitric nitrogen in the summer.

As regards the cases with vegetation, the yields of grass, beet, and wheat were not very high; there were excellent crops of oats in the cases manured with farmyard manure and sodium nitrate, an average yield of clover, and a good yield of sugar beet. There was most drainage from the grass case, very little with oats and clover. The vine case gave less drainage than the year before, but there was a distinct loss of nitrogen. The yield of sugar beet, on the land manured with farmyard manure, was comparatively low, but there was no loss of nitrates through drainage; whilst the cases manured with sodium nitrate gave larger crops, but lost a small amount of nitrate in drainage.

The loss of nitrates in drainage is inversely proportional to the amount of vegetation, and directly proportional to the amount of winter rain. N. H. J. M.

Analytical Chemistry.

Estimation of the Halogens in mixtures of their Silver Salts. By FRANK A. GOOCH and CHARLOTTE FAIRBANKS (*Zeit. anorg. Chem.*, 1895, **9**, 349—355, also *Amer. J. Sci*; **50**, 27—32).—Treatment of the haloïd silver salts with mercuric cyanide, ammoniacal or acid cuprous chloride, potassium ferrous oxalate, chromous chloride, chromous acetate, or magnesium powder and dilute acids, gave results of no analytical value. A mixture of hydrogen sulphide and ammonium sulphide vapour at 200° completely decomposes silver chloride, but the bromide and iodide only partially, and the reaction is not completed even at much higher temperatures. Good results, as the analyses show, are obtained by modifying Kinnicut's electrolytic method. The mixed silver chloride and bromide is collected on an asbestos filter, which is fitted with a platinum sieve above the asbestos, washed, dried, weighed, and cautiously fused; the electrolysis is conducted in presence of alcoholic oxalic acid solution (25 per cent. alcohol 1 part, oxalic acid 0·1 part). If iodide is present, the method must be modified by employing as solution a mixture of 40 per cent. acetic acid (2 vols.) neutralised with ammonia, to which is added ammonia (1 vol.), aldehyde of 75 per cent. (1 vol.), and alcohol (1 vol.); any ammonium iodate which may be deposited on the anode is readily removed by dipping it into hot water. The analyses occupy about 7 hours; the current = 0·5—0·25 ampère. The use of sulphuric acid for the electrolysis is objectionable, as its removal from the spongy silver is extremely difficult. J. B. T.

Estimation of Fluorine. By Paul Jannasch and A. Röttgen (*Zeit. anorg. Chem.*, 1895, **9**, 267—273).—The method consists in distilling off the fluorine as hydrogen fluoride in an apparatus made entirely of platinum; the distillation flask being arranged so that air and carbonic anhydride can be passed through it. Sodium fluoride is introduced into this flask, and then sulphuric acid, and the mixture heated in a bath of phosphoric acid at 155—160°, a brisk current of air and a slow current of carbonic anhydride being passed through the flask at the same time. The hydrogen fluoride is carried over with the gases and, by means of an inverted funnel, is passed into a solution of pure sodium hydroxide contained in a platinum dish. When all the hydrogen fluoride is expelled, which takes about 4—6 hours, the apparatus is allowed to cool with the current of gases passing through it. The soda solution containing the fluorine is precipitated with a hot 25 per cent. calcium chloride solution, and the precipitate after being washed and ignited, is treated with the theoretical quantity of dilute acetic acid for dissolving the calcium carbonate; a slight excess of acetic acid is then added and the solution evaporated to dryness on the water-bath and heated until the odour of acetic acid has disappeared. The dry residue is treated with hot water, and the insoluble calcium fluoride collected, washed, and ignited in a platinum crucible. The results are accurate and agree with those obtained by the ordinary methods.

The authors are engaged in the application of this method to the analysis of cryolite, fluor spar, and silicates. E. C. R.

Precipitation and Gravimetric Estimation of Carbonic Anhydride.—By Frank A. Gooch and I. K. Phelps (*Zeit. anorg. Chem.*, 1895, **9**, 356—359; also *Amer. J. Sci.*, **50**, 101—103).—The weighed carbonate is placed in a flask of about 50 c.c. capacity; boiled water (20—30 c.c.) is added, and a small test-tube containing hydrochloric acid. This flask is connected with the longer limb of a bent tube in which a bulb is blown just above the neck of the flask; to the shorter limb a tube is attached, passing through the cork of the absorption cylinder to the bottom and having a valve at the lower end; the absorption cylinder consists of a wide glass tube to the bottom of which is fastened a rubber balloon, the top being closed by a doubly bored rubber cork, a short tube with a stopcock is fitted in the one opening whilst through the other passes the tube from the evolution flask. The carbonic anhydride is absorbed by means of barium hydroxide solution (5 per cent.). When the evolution of carbonic anhydride from the flask ceases, the liquid is heated until the barium hydroxide solution almost boils, the latter is then decanted through a filter moistened with water and xylene (5 c.c.), the carbonate thoroughly washed with hot water, and finally once with alcohol. The barium carbonate on the filter and in the absorption tube is dissolved in hydrochloric acid, and precipitated with sulphuric acid. The operations are quickly performed, and the results are extremely accurate. J. B. T.

Estimation of Selenious acid by means of Potassium Permanganate. By FRANK A. GOOCH and C. F. CLEMONS (*Zeit. anorg. Chem.*, 1895, **9**, 360—364; also *Amer. J. Sci.*, **50**, 51—54).—Selenious acid readily decolorises potassium permanganate solution; but, in presence of sulphuric acid, secondary actions are apt to vitiate the analytical results. This difficulty has been successfully overcome by limiting the quantity of sulphuric acid, and oxidising at a comparatively low temperature.

Selenious anhydride is dissolved in dilute sulphuric acid (5 per cent. by vol.), and potassium permanganate solution (N/10) added in excess; the liquid is then rendered colourless by the addition of a known quantity of normal oxalic acid solution, and the excess of this is determined with permanganate, in the usual manner, at a temperature not exceeding 50—60°. J. B. T.

Estimation of the Manurial Value of Phosphates. By G. PATUREL (*Ann. Agron.*, 1895, **21**, 325—342; compare this vol., ii, 28).—The following method is recommended as giving results in accordance with ideas established by actual vegetation experiments. The powdered phosphate (1 gram) is treated with 500 c.c. of water containing crystallised citric acid (5 grams). The mixture is frequently shaken for 24 hours, filtered, and the phosphoric acid determined. The total phosphoric acid is also determined, and the relation of the soluble to total phosphates calculated. Basic slags are treated gradually with the citric acid solution, so as to dissolve most of the calcium carbonate before attacking the phosphate. N. H. J. M.

Use of Perchloric acid in the Estimation of Potassium. By D. ALBERT KREIDER (*Zeit. anorg. Chem.*, 1895, **9**, 342—348).—See this vol., ii, 444.

Analytical Characters of a Mixture of Salts of Barium, Strontium, and Calcium. By HENRI BAUBIGNY (*Bull. Soc. Chim.*, 1895, [3], **13**, 326—330).—The metals in question having been precipitated as carbonates in the usual manner, are redissolved in hydrochloric acid, taking care to avoid excess; the barium is then precipitated as chromate in acetic acid solution, and the strontium as sulphate by means of dilute potassium sulphate (0·25 per cent.). The calcium is reprecipitated with potassium carbonate to eliminate the chromate, and the solution of its chloride, from which free hydrochloric acid has been removed by the addition of ammonium acetate, is precipitated by potassium ferrocyanide in presence of a large excess of ammonium chloride. The residual strontium is not precipitated under these conditions, but the method is not available for its separation, as it is liable to be carried down with the potassium calcium ferrocyanide.

When it is required to test for calcium only, the barium and strontium may be removed by means of a concentrated solution of potassium sulphate.

A modification of the first plan, in which the elimination of the chromate is avoided, is based on the reduction of the free chromic acid by the ferrocyanide. The barium having been removed as chromate, the strontium, if present, is entirely precipitated by a saturated solution of potassium sulphate; the filtrate is then saturated with ammonium chloride, and the calcium precipitated by excess of ferrocyanide.

In the case of extremely dilute solutions, such as might remain after the precipitation of the metals as carbonates in presence of a very large excess of ammonium chloride, the barium may be entirely precipitated with normal chromate, and the strontium recognised by the addition of a drop of sulphuric acid to the filtrate. The calcium is then detected by the addition of potassium ferrocyanide to a fresh portion of the original solution saturated with ammonium chloride.

JN. W.

Separation of Metals in a Current of Hydrogen Chloride. By PAUL JANNASCH and F. SCHMITT (*Zeit. anorg. Chem.*, 1895, **9**, 274—282).—*Separation of Arsenic and Lead.*—The general method employed has been already described (this vol., ii, 89). The mixture of lead nitrate and arsenious acid is dissolved in nitric acid, the excess of acid carefully evaporated in a special glass vessel at 120° by means of a current of dry air, the residue being gradually heated to 200° in a current of dry hydrogen chloride. The arsenic, which is converted into arsenic chloride, distils over, and is collected in a 10 per cent. solution of nitric acid, which is evaporated on the water bath with concentrated nitric acid. The residue is dissolved in water and precipitated with a solution of magnesium chloride (*J. pr. Chem.*, **45**, 99). The residue of lead chloride remaining in the distillation apparatus is tested for arsenic, and is then either weighed as such or is dissolved in hydrochloric acid and the lead estimated by one of the ordinary methods.

Separation of Arsenic and Copper.—This is effected in a similar way to the preceding. The separation is not, however, complete when the distillation is carried out at 200—250°, but it is complete after heating for two hours at 300°. The residue of copper chloride is evaporated to dryness with concentrated nitric acid, carefully dried in an air bath, and finally cautiously heated over a bare flame and weighed.

Separation of Arsenic and Iron.—This is complete on heating at 110—120° during 1½ hours. After the distillation, the iron remains as beautiful, brownish-green scales of the chloride, which dissolve completely in water. The solution is heated with a small quantity of nitric acid, and the iron precipitated with ammonia.

Arsenic and tin cannot be separated by this method, for the chlorides of both volatilise easily at 120°.

Separation of Tin and Lead.—The mixture of tinfoil and lead nitrate is dissolved in aqua regia and the salts dried in a current of air, as previously described. The distillation in hydrogen chloride is effected at 200°, and is complete in about a quarter of an hour; the distillate of tin chloride, after adding ammonia in excess, and then ammonium sulphide, is acidified with hydrochloric acid, and the precipitate of tin sulphide collected, washed with a solution containing ammonium nitrate and hydrogen sulphide, and dried at 90°. It is then heated in the air as long as sulphurous anhydride is evolved, and finally at a higher temperature in a current of oxygen until the weight is constant.

The *separation of tin and copper* is effected in a similar way, and is complete after two hours at 250—300°. The residue contains both cupric and cuprous chlorides, the latter being formed by the elimination of chlorine from cupric chloride at the high temperature employed and in presence of hydrogen chloride.

Tin and iron are separated in a similar manner. The separation is complete after one hour at 120°. E. C. R.

Detection and Estimation of Metals in Fatty Oils. By HEINRICH FRESENIUS and A. SCHATTENFROH (*Zeit. anal. Chem.*, 1895, **34**, 381—390).—The experiments were made on oleates of the metals (lead, iron, zinc, aluminium), or in the case of copper, verdigris, dissolved in oil of sesame. With the exception of lead, all the metals could be estimated by simple incineration of the oil. Shaking the oil with dilute nitric acid in all cases extracts the whole of the metal. In the case of lead, the oil can be dissolved in ether and shaken with dilute sulphuric acid, when the whole of the lead separates as sulphate. Zinc is better extracted with hydrochloric acid; the acid solution is then evaporated with excess of mercuric oxide and the residue ignited, when the zinc is left as oxide. M. J. S.

Estimation of Formic acid by Potassium Permanganate. By HARRY C. JONES (*Amer. Chem. J.*, 1895, **17**, 539—541; compare Lieben, Abstr., 1894, ii, 219).—This is best effected by making the solution alkaline with sodium carbonate, warming, and treating it with a known excess of standard permanganate solution; the solution is then acidified with sulphuric acid, a measured excess of oxalic acid is run in, so as to destroy the permanganate and bring the precipitated manganese oxide into solution, and then the excess of oxalic acid is estimated by titration with the original permanganate solution; the permanganate equivalent of the solution of oxalic acid used being known, the difference between this and the total amount of permanganate used in the first experiment is the permanganate equivalent of the formic acid present.

It is not possible to determine oxalic acid in the presence of formic acid by titration with permanganate if the solution is acidified with sulphuric acid, as a portion of the formic acid is also oxidised under the circumstances. C. F. B.

Analysis of Must and Wine. By A. HALENKE and W. MÖSLINGER (*Zeit. anal. Chem.*, 1895, **34**, 263—293).—The authors lay stress on the importance of a more frequent and complete analysis of grape must than has been usual, and the necessity of employing standard methods. They here publish the results of the examination of 116 samples of must, obtained in 1892 from various localities in the Rhine-Palatinate, in which they have estimated the specific gravity, the alcohol, the dextrose and levulose, the tartaric acid, both free and as metal hydrogen tartrate, the malic acid, ash, phosphoric acid, total dry residue, and (by difference) the neutral non-saccharine constituents. The results are expressed in grams per 100 c.c.

The sample must be made perfectly clear by filtration, and owing to the rapid alterability of the must, all the determinations must proceed as nearly as possible simultaneously and without interruption. The sp. gr. (which they express in terms of Oechsle's degrees) must be determined by weighing, and not by the hydrometer. For the alcohol estimation, a table by Windisch gives at once grams per 100 c.c. The polarisation and copper reduction should be carried out on the same portion to eliminate small errors; the Landolt-Lippich polarimeter is recommended; and the copper reduction is performed according to Meissl's method, whose tables for obtaining the results in inverted sugar are also used. Applying the values given by Tollens, von Gubbe, and von Ost, for the specific rotation of the sugars, the formulæ for calculating the dextrose (d) and levulose (l) are $l = \frac{0{\cdot}525s + a}{1{\cdot}48}$ and $d = s - l$, where a is the lævo-rotation, and s the total sugar per 100 c.c. In nearly all the samples examined, the amount of levulose exceeded that of dextrose. In estimating the total dry residue, the application of heat is inadmissible. The only satisfactory method is to mix the weighed must (1 gram or less) with 10 grams of sand, and dry in a vacuum over sulphuric acid; 100—150 hours are required. The solids can, however, be calculated very closely from the sp. gr. of the aqueous residue of the alcohol distillation; 1° Oechsle corresponds with 0·2636 gram of dry residue per 100 c.c. For the total acidity, the wine should be heated just to the boiling point, as this expels carbonic anhydride and renders the end-reaction very sharp. The indicator is a bluish-violet litmus paper, prepared by dissolving 0·2 gram of azolitmic acid in 250 c.c. of boiling water, adding 1·25 c.c. of normal potash, soaking strips of filter paper (Schleicher and Schull's 595), and drying the strips in the dark. The point at which the wine ceases to redden the test paper is taken as the end of the titration. For estimating the total tartaric acid, the methods of Berthelot-Fleurieu, Nessler-Barth, and Haas leave much to be desired. The authors prefer to make use of the very sparing solubility of potassium hydrogen tartrate in a 10 per cent. solution of potassium chloride (see Grosjean, Trans., 1879, 348). To 100 c.c. of the must are added 2 c.c. of glacial acetic acid, and 15 grams of powdered potassium chloride, and, when this is, as far as possible, dissolved, 20 c.c. of alcohol. After a few minutes' stirring and 15 hours' repose, the precipitate is collected on a Gooch filter, using a filter-bed of paper fibre. After washing several times with a solution of 15 grams of potassium chloride in 100 c.c. of water and 20 c.c. of alcohol, and then with strong alcohol alone, the acidity of the precipitate is titrated, and a correction of 0·15 c.c. of normal alkali is made for the potassium hydrogen tartrate not precipitated. In applying this method to must, it is necessary to precipitate a second time, as it is found that other acid substances, of unknown nature, are simultaneously precipitated the first time. The tartaric acid existing as potassium hydrogen tartrate is best found from a comparison of the alkalinity of the ash of the must with the total tartaric acid found.

The preparation of the ash requires much care. The residue must be slowly charred in a covered platinum basin without visible combustion until it yields a colourless aqueous extract, then exhausted with boiling water, and the residue very slowly burnt to a white ash. The entire ash is rendered acid with a measured quantity of N/2 acid, and the excess of acid titrated, or the potassium and calcium may be estimated apart by making separate titrations of the total aqueous extract of the ash, and of the residue insoluble in water. The malic acid is deduced from the difference between the total tartaric acid and the total acidity. M. J. S.

Analyses of Austro-Hungarian Sweet Wines. By LEONHARD ROESLER (*Zeit. anal. Chem.*, 1895, **34**, 354—361).—These wines are prepared by extracting dried grapes with a good ordinary wine and fermenting the extract. They contain usually 10—15 volumes per cent. of alcohol, 0·55—1·2 grams of phosphoric acid, 2—5·5 grams of total ash, 100—250 grams of sugar (inverted), 26—45 grams of extractive matters other than sugar, 5—10 grams of glycerol, and 5—10 grams of total free acid per litre. Tokay is, on the average, slightly more alcoholic, contains rather less ash (seldom reaching 4 grams per litre), about the same amount of non-saccharine extractive matters, but invariably more than 10 grams of glycerol, and usually above 15 grams, per litre. M. J. S.

Examination of Decomposed Human Remains for Alkaloïds and Glucosides. By CARL KIPPENBERGER (*Zeit. anal. Chem.*, 1895, **34**, 294—346).—The well-known difficulty of distinguishing, in chemico-legal cases, the ptomaïnes from the poisonous vegetable alkaloïds, has led to numerous proposals for modifications of the recognised methods for the extraction and identification of the latter. The author confirms this difficulty by showing that extracts of putrefied human remains, whether made with acid or alkaline liquids, whether aqueous or alcoholic, all contain substances which give precipitates with the ordinary reagents for the vegetable alkaloïds. Both classes of alkaloïds, together with the peptone and albumin occurring in cadaveric extracts, are precipitated by tannin, but, on treating the moist precipitate with water containing glycerol, the tannates of the vegetable alkaloïds are all dissolved, whilst the cadaveric products liable to be confounded with them are left in the insoluble residue. Dry glycerol and tannin, when heated together, unite, with elimination of water, forming a compound which the author names "glycerotannic acid;" its solvent power was demonstrated for 34 of the commoner alkaloïds and glucosides.

The process of extraction is as follows. The cadaveric matter is digested at 40° for two days—with or without addition of water—with glycerol, in which abundance of tannin has been dissolved; the liquid is then separated from the solid matter by pressing, and, after heating to 50° to coagulate blood fibrin and traces of albumin, is cooled and filtered. It is then shaken with light petroleum to remove fat, and the last traces of petroleum are removed from the aqueous liquid by warming on the water bath; the alkaloïds are then extracted in two portions by shaking with chloroform, first in presence of acid, and, secondly, after making alkaline with potash. Chloroform is much to be preferred to the ether of the Stas-Otto process, since it removes with quantitative completeness many alkaloïds which are with difficulty extracted by ether. The exceptions are morphine, narceïne, curarine, and strophantin. The two first can be extracted by a mixture of chloroform and alcohol, after the alkali hydroxide has been converted into carbonate by adding sodium or potassium hydrogen carbonate, and the last can be removed by ether-chloroform (equal volumes), preferably after saturating the solution with sodium chloride. If metallic poisons have to be looked for, the original extraction should be made with acidified alcohol, and the glycerotannic acid treatment applied only to the aqueous solution of the residue left after evaporating the alcohol. In either case, the alkaloïds are left on evaporating the chloroform solution.

Separation of the Alkaloïds from one another.—In this section a mass of detail is given, of which the following is a rough outline.

Class 1. *Alkaloïds, &c., Extracted by Chloroform from Acid Solution.*—Colchicine, digitalin, papaverine, narcotine, delphinine, aconitine, agaricin (all precipitated by tannin solution which has been acidified with hydrochloric acid almost to the point of becoming turbid); picrotoxin, and cantharidin (not precipitated by acidified tannin). Of these, cantharidin, picrotoxin, agaricin, colchicine, and digitalin are precipitated by potash; whilst delphinine, aconitine, narcotine, and papaverine are not so precipitated. Aconitine, whose picrate is insoluble in ammonia, can be separated by this means from narcotine and papaverine, whose picrates are soluble; and narcotine is separable from papaverine by the solubility of its acid oxalate in cold alcohol.

Class 2. *Alkaloïds Extracted by Chloroform from Alkaline Solution.*—Brucine, strychnine, emetine, veratrine, narcotine, codeïne, thebaïne (all precipitated by acidified tannin solution); atropine, sparteïne, and nicotine (not precipitated by acidified tannin). Nicotine, conine, and sparteïne can be distilled over with steam and thus separated from atropine. Strychnine may be separated from brucine by adding a small excess of potassium ferrocyanide, filtering after 15 minutes, and rapidly washing, then treating with ammonia, and extracting with chloroform; brucine from veratrine, codeïne, and emetine by taking advantage of the difference in the solubilities of their chromates in water feebly acidified with acetic acid; brucine from thebaïne by the insolubility of its dichromate in hydrochloric acid; brucine from veratrine and thebaïne by treating the alcoholic solution with alcoholic mercuric chloride. Thebaïne picrate is insoluble in acetic acid; the picrates of codeïne and strychnine are soluble.

Class 3. *Alkaloïds, &c., not Extracted from Solution by Chloroform.*—Narceïne and strophantin are precipitated by acidified tannin solution; morphine not. Also morphine may be separated from narceïne by mixing with a large quantity of ammonium chloride and adding N/20 iodine solution. The narceïne alone is precipitated as periodide (see below), and the excess of iodine is titrated in the filtrate.

Volumetric Estimation of the Individual Alkaloïds.—After weighing the residue from the chloroform solution, it must be titrated to ascertain whether it consists entirely of the alkaloïd in question. Veratrine, narcotine, atropine, codeïne, papaverine, thebaïne, strychnine, and narceïne (all in hydrochloric acid solutions), and morphine (in neutral solution) can be titrated with iodine. A measured volume of the dilute alkaloïd solution is placed in a small stoppered flask, a small excess of N/20 solution of iodine in potassium iodide is added, and the mixture left in repose from 5 to 25 minutes, or until the supernatant liquid begins to clarify. The reaction is in no case completed instantly. The liquid is then filtered through glass-wool and asbestos into a clean, dry, stopcock burette, and the excess of iodine in a measured portion is titrated with thiosulphate and starch. In all cases, 1 mol. of the alkaloïd precipitates 3 atoms of iodine, and the author gives for the precipitates the general formula Alk,HI,I_2, and assumes that the HI of the formula is derived from a reaction of iodine with water in which hydrogen peroxide is produced.

Mayer's reagent (potassio-mercuric iodide) can be employed for the titration of most of the alkaloïds. The end of the precipitation is ascertained by placing a drop of the liquid upon the upper of two superposed filters, and testing the moistened spot on the lower filter with ammonium sulphide.

Brucine (which cannot be titrated by iodine), strychnine, codeïne, and thebaïne, can be very well titrated by mercuric chloride alone, testing as above, but stirring and rubbing for some time with the glass rod before taking the drop for testing. The presence of a mineral acid is not objectionable, but acetic acid and alcohol must be avoided.

In conclusion, three test analyses are given, in which the above methods were applied with excellent results to the recovery of weighed amounts of narcotine and codeïne, strychnine and veratrine, morphine and narceïne respectively from putrefied human remains.

M. J. S.

The Phosphomolybdic acid Test in Lard Analysis. By George F. Tennille (*J. Amer. Chem. Soc.*, 1895, ii, 33—41).—The author has investigated this test which has been strongly recommended for the detection of vegetable oil in lard. The result is that the test does not work unless the amount of oil exceeds 10—15 per cent., but such large additions are more safely detected by other methods. The test is, therefore, but of slight analytical value. L. de K.

Tests for Distinguishing Atropine from Strychnine. By Dioscoride Vitali (*Chem. Centr.*, 1894, ii, 816; from *Boll. Chim. Farm*, **33**, 449) —Atropine when evaporated with nitric acid develops the odour of hawthorn; strychnine remains odourless; moreover, the residue with strychnine is yellow, whilst that of atropine is colourless. When the atropine residue is moistened with alcoholic potash and evaporated, a violet residue is obtained; strychnine gives a yellow coloration, passing into reddish-violet on further addition of potash. Addition of water to the alcoholic potash mixture renders the atropine colourless; strychnine turns yellow. The atropine residue, with ammonia, yields little yellow drops which change to violet on adding alcoholic potash; strychnine under these circumstances gives with ammonia a reddish-orange coloration, and then, on adding alcoholic potash, a transitory violet coloration which passes into blood-red. If this ammoniacal solution is agitated with chloroform, and the latter evaporated, the atropine residue is nearly colourless, but turns permanently violet on addition of alcoholic potash; the strychnine residue is yellow, and turns reddish-orange with alcoholic potash. L. DE K.

Estimation of Indigotin. By JOSEF SCHNEIDER (*Zeit. anal. Chem.*, 1895, **34**, 347—354).—All the methods hitherto published are wanting in accuracy. The use of pure naphthalene as a solvent presents many advantages, and the apparatus is arranged as follows. A 300 c.c. conical flask is provided with a condenser, which has an entrance at the side of the tube, but has its lower end drawn out to a point and bent sideways. This delivers the condensed naphthalene into a cartridge-shaped filter (Schleicher's extraction thimbles would serve well if made of smaller dimensions), suspended by a thread inside the flask; in this filter is placed 0·5 to 1 gram of the indigo, mixed with glass-wool, and the flask, supported on double wire gauze, is heated with a flame. Fifty grams of naphthalene, which must be free from ash, is used, and the cohobation is continued for a short time after the filtrate ceases to be coloured, about 5½ hours being required. The indigotin is then precipitated (as in Stein's process) by adding to the naphthalene solution 150 c.c. of ether (which should be free from alcohol), collecting the precipitated indigotin on a weighed filter, washing with ether, and drying at 100°. It is well to weigh with the empty filter a separate piece of paper, by which the last traces of indigotin can be wiped out from the flask. The loss of indigotin from decomposition, volatilisation, and imperfect precipitation amounts to 1—4 milligrams. Perfect dryness of the apparatus and materials is necessary in order to avoid explosions.

M. J. S.

Estimation of Peptones. By DUTTO (*Chem. Centr.*, 1894, ii, 1022; from *Pharm. Centr. Halle*, **35**, 636).—The solution of the peptones is precipitated with potassium bismuth iodide, and the precipitate, after being washed with water very slightly acidified with sulphuric acid, is dried in a vacuum. The bismuth contained in it is now estimated as Bi_2O_3. One gram of peptone corresponds with 0·141—0·147 gram of metallic bismuth. L. DE K.

General and Physical Chemistry.

Possible Explanation of the two-fold Spectra of Oxygen and Nitrogen. By EDWARD C. C. BALY (*Proc. Roy. Soc.*, 1895, **57**, 468—469).—Experiments have been undertaken to determine if the two spectra of oxygen are produced by two distinct gases resulting from a dissociation of oxygen, a combination of the two being what is usually called oxygen.

Oxygen was sparked in an apparatus similar to that used by J. J. Thomson in his experiments on the electrolysis of steam. In the first experiments, the distance between the electrodes was 35 mm., and the highest pressure compatible with the appearance of the two spectra was made the starting point of the experiments. The fractions obtained from the anode and cathode were weighed. They follow the lines of Thomson's results, inasmuch as with long sparks a lighter fraction was obtained at the cathode, and with short sparks a heavier fraction. The fractions from the anode were not so definite as from the cathode, although the difference was in the right direction. The density of the cathode fraction with long sparks varied from 15·78 to 15·80, with short sparks from 16·00 to 16·06; the density of the unsparked oxygen from 15·87 to 15·89. The density of the cathode fraction from oxygen, previously for three days fractionated with short sparks, was 15·75. E. C. R.

Fluorescence of Argon and its Combination with the Elements of Benzene. By MARCELLIN BERTHELOT (*Compt. rend.*, 1895, **120**, 1386—1390).—The combination of argon with benzene vapour under the influence of the silent electric discharge (this vol., i, 412, and ii, 337) takes places slowly, and is influenced by the presence of mercury vapour, which intervenes in the form of a volatile compound. The luminescence, which is at first violet and visible only in the dark, becomes green after about an hour, and shows lines at 579, 577, 546, and a band at 516·5. A photograph of the spectrum shows the principal bands of nitrogen, and feebler lines at 436, 405, and 354. As the discharge continues, the intensity of the luminescence as a whole and of the lines 579, 577, and 546 steadily increases, but that of the band 516·5 diminishes. After seven hours, the nitrogen bands disappear, probably because all the nitrogen has combined with the benzene. After eight hours more, the luminescence has a brilliant emerald-green colour, and is visible in full daylight. A photograph of the spectrum shows the lines 579, 577 and 546, 436, 405, 354, 313, 312, two faint lines at 420 and 416, and the lines 385 and 358, and this spectrum persists during 30 hours of uninterrupted discharge.

The band 516·5 is due to hydrocarbons at low pressure, and the lines 313 and 312 are due to mercury vapour at low pressure. The other lines seem to coincide with lines observed by Crookes in argon under low pressure. As already pointed out (*loc. cit.*), none of the lines coincide with the helium line nor with the principal line of the aurora borealis 557. The strong argon line at 555·7 is, however, somewhat near the latter, and it seems probable that there is some relation between the presence of argon in the atmosphere and the production of the aurora borealis.

It is particularly noteworthy that many of the lines observed by Crookes in the argon spectrum, and many of those shown by the green luminescence, coincide with lines of mercury vapour under low pressure, for instance, the lines at 579, 577, 546, 436, 405, 354. The lines at 420, 416, 385, and 358 seem to belong to argon alone, and the lines 313 and 312 to mercury alone. No known gas shows these lines and the green luminescence when subjected to the silent discharge; they are not shown by argon in presence of mercury vapour at the normal pressure, nor by nitrogen in presence of benzene vapour or carbon bisulphide and mercury, and with argon in presence of benzene or carbon bisulphide and mercury they are not seen until after the discharge has acted for some time. They appear only after the benzene has been partially converted into condensation products. One of these products at the moment of its formation begins to unite with both argon and mercury, the two being associated probably because they both have monatomic molecules.

The green luminescence persists even after all the benzene seems to have disappeared, but it ceases after very prolonged action of the discharge, probably because the whole of the benzene has been altered. When once the green luminescence is well established, the compounds which cause it are stable, and if the discharge be interrupted, even for several hours, and is started again, the luminescence appears almost immediately with its former intensity. Neither the product of condensation alone nor the residual gas alone shows the phenomenon, and a mixture of fresh argon with the product of condensation shows the characteristic tint and lines after the discharge has acted on it for a long time. The addition of a trace of benzene to the mixture materially shortens the time required, but an excess of benzene increases it. C. H. B.

New Gas obtained from Uraninite. By J. Norman Lockyer (*Proc. Roy. Soc.*, 1895, **58**, 67—70, 113—119, 192—195).—An account of the spectroscopic results obtained with the gases extracted from uraninite and other minerals by heating in a vacuum. A table is given comparing the lines photographed between λλ 3889 and 4580, with chromospheric lines, eclipse lines (1893), and some stellar lines (compare this vol., ii, 431). H. C.

Direct Spectrum Analysis of Minerals and Fused Salts. By Arnaud de Gramont (*Compt. rend.*, 1895, **121**, 121—123).—Many minerals have sufficient conductivity or volatility to permit the passage of a condensed electric spark between two small fragments of the mineral attached to the poles of the coil. With a condensed spark, the spectrum shows the lines both of the metals and of the non-metals present in the mineral; without the condenser, the spectra of the non-metals disappear, and those of the metals show only the brightest lines.

Certain fused salts behave in a similar way, and when the condensed spark is used, the spectrum contains the lines of all the elements present, together with some air lines, which, however, are much enfeebled, especially if the striking distance is short. Without the condenser, the spectra are complex and characteristic of each particular salt; probably they are produced by undissociated molecules.

In the case of minerals, the use of the condensed spark gives the best results, but, in the case of salts, the spark without a condenser often gives valuable indications.

If the electrodes are coated with sulphur, arsenic, or selenium, a condensed spark gives the line spectrum of the element, and the latter does not burn; an uncondensed spark, on the other hand, causes the non-metals to ignite. C. H. B.

Absorption Spectra of Dilute Solutions. By THOMAS EWAN (*Proc. Roy. Soc.*, 1895, **57**, 117—161).—Experimental details of a paper previously published in an abridged form (this vol., ii, 433).

Refraction and Dispersion of Liquid Oxygen, and the Absorption of Liquid Air. By GEORGE D. LIVEING and JAMES DEWAR (*Phil. Mag.*, 1895, **40**, 268—272).—The refraction was determined by the method previously employed (Abstr.. 1894, ii, 37), but with a vacuum-jacketed globe in place of the cylindrical tube. The values so obtained were λ 4416 (blue cadmium), $\mu = 1·2249$; λ 6438 (red cadmium), $\mu = 1·2211$; λ 5350 (green thallium), $\mu = 1·2219$; λ 6705 (red lithium), $\mu = 1·2210$; λ 5892 (D sodium), $\mu = 1·2219$. The value for the D line is considerably less than that previously obtained. The refraction constants for the mean green are hence 0·1242 (Lorenz) and 0·1953 (Gladstone), the similar values for gaseous oxygen being 0·12631 and 0·18947.

Cauchy's coefficient of dispersion is calculated, and found to be 0·0064, a number agreeing with the mean value of Mascart's determinations for the gaseous element. The absorption spectrum of liquid air was also examined, and the absorption bands observed to be better developed by pure oxygen than by five times the thickness of air, Janssen's law being apparently obeyed. The bands also were sensibly widened and strengthened by the reduction of the temperature. L. M. J.

Active Alkylic Salts of the α-Hydroxybutyric acids. By PHILIPPE A. GUYE and CHARLES JORDAN (*Compt. rend.*, 1895, **120**, 1274—1276).

	$[\alpha]_D$.
I. Butylic acetylhydroxybutyrate	−27·9
Isobutylic "	−30·7
Heptylic "	−21·8
Octylic "	−18·6

	$[\alpha]_D$.	Corrected.
I. Isobutylic acetylhydroxybutyrate.....	+27·9	+27·9
,, propionylhydroxybutyrate..	+20·5	+27·7
,, butyrylhydroxybutyrate ...	+18·0	+24·4
,, valerylhydroxybutyrate....	+13·9	+18·7
,, caproylhydroxybutyrate ...	+12·1	+16·1
,, nonanoylhydroxybutyrate..	+ 9·0	+12·1
,, benzoylhydroxybutyrate ...	− 0·89	− 1·2

III. Isobutylic α-chlorobutyrate..........	−10·5
,, α-bromobutyrate..........	+ 8·2
,, nitroisobutyrate	−43·2

IV. *Condensation Products with Aldehydes* (this vol., i, 332).—

	$[\alpha]_D$.
Methylene derivative of lævogyrate acid.......	−5·9
Racemic valeraldehyde and dextrogyrate acid..	+6·5
Dextrogyrate valeraldehyde and dextrogyrate acid	+8·4

V. *Amylic Valerylhydroxybutyrates*, obtained by the action of valeric chloride on amylic hydroxybutyrates :—

(*a.*) Racemic acid, racemic alcohol, active chloride ..	+ 0·1
(*b.*) ,, active ,, racemic chloride.	+ 0·6
(*c.*) Active acid, racemic alcohol, racemic chloride ..	−15·3
(*d.*) ,, active ,, active ,, ..	−15·1

On the assumption of a regular tetrahedron with the masses at the four solid angles, the compounds in Series I should be dextrogyrate; the compounds in Series II should be lævogyrate up to the butyryl derivative, and dextrogyrate from the caproyl derivative. The corrected values in Series II are obtained by multiplying the observed values by 1·35, the ratio between the dextrogyrate and lævogyrate isobutylic hydroxybutyrates. It is obvious that the simplified formula for the product of asymmetry is not sufficient in the majority of these cases.

In Series V, there is evidence of the superposition of the optical effects of three asymmetric carbon atoms; according to the rules already established (this vol., i, 149 and 195), the algebraic sum of the rotatory powers of the compounds (*a*), (*b*), and (*c*) should be equal to the rotatory power of the compound (*d*). C. H. B.

Optical Activity of Amylic Derivatives in the state of Liquid and of Vapour. PHILIPPE A. GUYE and A. P. DO AMARAL (*Compt. rend.*, 1895, **120**, 1345—1348).—The following results show that, except in the case of amylamine, the rotatory power of liquid amylic compounds diminishes with a rise of temperature.

Measurements of the rotatory powers of some of these compounds in the form of vapour, by methods which will be described subsequently, show that in the case of amylic acetate, amylic chloracetate, diamyl, and amylamine, the differences between the rotatory powers

	t.	$[\alpha]_D$.	*t.*	$[\alpha]_D$.
Valeraldehyde........	13·0°	+14·09	72·5°	+11·14
Valeraldoxime	20·0	+11·13	50·9	+ 9·97
Amylic acetate	18·0	+ 2·54	57·6	+ 2·51
Methylic valerate.....	18·0	+14·63	—	—
Amylic chloracetate...	26·8	+ 3·00	51·3	+ 2·97
Diamyl...............	19·9	+10·01	—	—
Isobutylamyl.........	21·0	+ 5·31	65·2	+ 5·20
Amylamine...........	20·0	− 1·58	67·1	− 1·67
Diamylamine	18·0	+ 5·59	57·9	+ 4·71
Amylic bromide	18·0	+ 2·51	61·9	+ 2·07
Amylic iodide........	22·0	+ 3·67	64·6	+ 3·13
Amylic alcohol	16·0	− 4·52	76·0	− 4·12
Valeric acid..........	11·0	+11·27	59·5	+10·84

in the states of liquid and vapour respectively are not greater than the errors of experiment, and all that can be asserted is that, under both conditions, the rotatory power has the same sign. For the other compounds, the rotatory power is of the same order of magnitude under both conditions, but is somewhat lower in the case of the vapours, a result which agrees with the observations of Gernez on other compounds. Valeraldehyde is the only compound which shows a marked difference of rotatory power between the two states, but its rotatory power varies with the time, and it seems to undergo condensation at its boiling point. Amylic alcohol vapour has a higher specific rotatory power than the liquid, which is contrary to the usual rule.

	$[\alpha]_D$.	
	Liquid.	Vapour.
Valeraldehyde	+14·6	+ 7·1 to 6·4
Methylic valerate ...	+16·4	+14·3 „ 14·5
Amylic bromide	+ 2·8	+ 1·9
Amylic iodide......	+ 5·6	+ 3·9 „ 4·1
Diamylamine.......	+ 6·3	+ 5·3 „ 5·9
Amylic alcohol	− 5·1	− 5·8 „ 6·5
Valeric acid........	+13·5	+10·7 „ 10·9

C. H. B.

Molecular Rotation and Molecular Deviation. By PHILIPPE A. GUYE (*Compt. rend.*, 1895, **120**, 876—877).—In reply to a recent criticism by Aignan, the author points out that he does not propose to substitute the molecular deviation for the molecular rotation. Neither of the two expressions gives a value which is independent of the conditions under which the polarimetric measurements are carried out, and to each therefore some correction has to be applied. The subject is being further investigated by the author. H. C.

Guye's Formula. By ALBERT COLSON (*Compt. rend.*, 1895, **120**, 1416—1417).—The author again calls attention to some of the objections which he has raised to Guye's formula for the product of asymmetry (Abstr., 1893, i, 457, ii, 105, 255; 1894, ii, 435). The enormous variations which take place in the rotatory powers of certain liquids with changes in temperature show that Guye's determinations are not sufficiently definite. Some of the numbers also change their sign if in place of yellow light other rays are employed; for the sense in which the variation in the rotatory power occurs in passing from one ray to another is not the same for all substances. For example, the following rotatory powers were determined at 15° in a layer 0·20 metre long.

	Line D.	Green line. (thallium).	Red line. (strontium).	
Methylic amylic oxide	20	10	—	decrease
Isoamylic oxide	41	65	45	increase
Isobutylic amylic oxide	14	24	—	increase
Amylic acetate	63	—	54	decrease

H. C.

Magnetic Rotation of the Plane of Polarisation of Light in Liquids. Part I. Carbon Bisulphide and Water. By JAMES W. RODGER and W. WATSON (*Proc. Roy. Soc.*, 1895, **58**, 234—237).—The aim of the investigation is the determination in absolute measure of the magnetic rotation of liquids at different temperatures, the effect of the chemical nature of the liquid on this property, and the correlation with other physical properties.

The results obtained for the rotation of carbon bisulphide may be summed up in the following equation, where γt is the value of Verdet's constant at the temperature t,

$$\gamma t = 0{\cdot}04347 - 0{\cdot}0_4 737t.$$

The expression connecting rotation and temperature is therefore linear. In the case of water, the results are best represented by

$$\gamma t = 0{\cdot}01311 - 0{\cdot}0_6 4t - 0{\cdot}0_7 4t^2.$$

Here the rate of change of the rotation with temperature increases as the temperature rises.

In the case of water, the quotient γ/ρ, where ρ is the density, is practically constant up to 20°, it then very slowly increases, the rate of increase between 20° and 100° being practically constant. For carbon bisulphide, the quotient γ/ρ decreases at a constant rate as the temperature rises, the rate of decrease being very much greater than the rate of increase in the case of water.

The measure of the molecular rotation which is usually employed in chemical investigations is

$$(\mathrm{M}\gamma/\rho)\text{ substance}/(\mathrm{M}\gamma/\rho)\text{ water},$$

where M is the molecular weight. Although the authors postpone a detailed discussion of the validity of this expression, they show that for carbon bisulphide, at any rate, its value changes with the temperature, and hence the conclusions obtained by its use regarding questions of chemical constitution, especially of tautomerism, are affected on this account.

They also point out that the above expression involves the properties of water. The only justification for the use of water in relative observations is the elimination of variations in the strength of the magnetic field in which the observations are made. If the temperature of observation is always the same, this can readily be done. If, on the other hand, the temperature varies, it is essential to know how the rotation of water alters with the temperature. Up till now, the authors have made observations on eight liquids, besides water and carbon bisulphide, and in all cases except that of water the relation between rotation and temperature is linear, and the quotient, rotation divided by density, diminishes as the temperature rises. It is highly probable, therefore, that as regards magnetic rotation, as in the case of so many other properties, the behaviour of water is exceptional, and hence it is particularly ill suited for the use to which it has been put. H. C.

Electromotive Force of the Clark, Gouy, and Daniell Standards. By C. Limb (*Compt. rend.*, 1895, **121**, 199—200).—The author has determined the E.M.F. of the following standard cells.

Latimer Clark	1·4535 volts.
Gouy	1·3928 „
Daniell (Fleming type)	1·0943 „

The measurements were made at 0°. H. C.

Electrolysis of Gases. By Joseph J. Thomson (*Proc. Roy. Soc.*, 1895, **58**, 244—257).—In the experiments described in this paper, the spectroscope has been used to detect the decomposition of gases by the electric discharge and the movement of the ions in opposite directions along the discharge tube. A very simple method of showing the separation of the ions produced by the discharge of electricity through a compound gas such as hydrogen chloride, when the discharges through the constituent gases of the compound are of distinct and different colours, consists in the use of a capillary tube of very fine bore, the finer the better, with platinum wires for electrodes inserted in two small bulbs blown on the ends of the tube.

With hydrogen chloride at very low pressure, when first the discharge passes through the tube, the colour is uniform throughout and of a greenish-grey; after the discharge has been passing for a little time, the end of the tube next the cathode gets distinctly red, whilst that next the anode gets green, the discharge through hydrogen in a capillary tube being red, through chlorine green. When a tube is filled with hydrogen and a very small quantity of chlorine then let in through a side tube, after the discharge has been running through the tube for a short time, the chlorine spectrum is found to be bright at the positive electrode, although no trace of it can be detected at the negative. If the induction coil is reversed, so that what was before the positive electrode becomes the negative, the first effect observed is that the chlorine spectrum flashes out with greater brilliancy at the old positive electrode, and is much brighter than at any previous period. This, however, only lasts a second or two; the chlorine spectrum rapidly fades away, and for a time is not visible at either electrode, but it soon appears at the new positive electrode, having been thus transferred from one end of the tube to the other. On again reversing the coil, the same phenomenon is repeated, and there is apparently no limit to the number of times this effect may be obtained, the chlorine being driven from one end of the tube to the other by reversing the coil. The same effect is obtained when a little bromine vapour is introduced into the tube instead of chlorine.

If a little vapour of sodium is introduced into the middle of a capillary tube filled with air at a low pressure, when the discharge is run through the tube the movement of the sodium vapour to the negative electrode is very apparent. When a small quantity of hydrogen is used in place of sodium vapour, the hydrogen also makes its way to the negative electrode.

When the discharge is passed through the vapour of sulphur monochloride, the chlorine lines are brighter at the negative than at the positive electrode, whilst the sulphur lines are brighter at the positive than at the negative. Thus the chlorine in this substance behaves in the opposite way to the chlorine in hydrogen chloride; in the latter compound, the chlorine ion has a charge of negative electricity, whilst in sulphur monochloride it has a charge of positive electricity. With the vapour of chloroform, it was found that both the hydrogen and the chlorine lines were bright on the negative side, whilst they were absent from the positive side, and that any increase in the brightness of the hydrogen lines was accompanied by an increase in the brightness of those due to chlorine. The spectrum on the positive side was that called the carbonic oxide spectrum. The appearance of the hydrogen and chlorine spectra at the same side was also observed in methylenic chloride and in ethylenic chloride. Even when all the hydrogen in methane was replaced by chlorine, as in carbon tetrachloride, the chlorine spectra still clung to the negative side. This is true also of silicon tetrachloride. From these experiments it would appear that the chlorine atoms in the chlorine derivatives of methane are charged with electricity of the same sign as the hydrogen atoms they displace.

When we can determine the signs of the electrical charges carried by the atoms in a molecule of a compound, we can ascertain whether any given chemical reaction does or does not imply interchange between the electric charges on the atoms taking part in the reaction. If we represent the sign of the charge of electricity carried by an atom by + or — placed below the symbol representing that atom, the following reaction,

$$\underset{-}{C}\underset{+}{H_4} + \underset{+}{Cl}\underset{-}{Cl} = \underset{-}{C}\underset{+}{H_3}\underset{+}{Cl} + \underset{+}{H}\underset{-}{Cl},$$

can be produced by a rearrangement of the atoms without any alterations of their electrical charges. If, however, we take the reaction

$$\underset{+}{H}\underset{-}{H} + \underset{+}{Cl}\underset{-}{Cl} = 2\underset{+}{H}\underset{-}{Cl},$$

we see that in addition to a rearrangement of the atoms there must in this case be an interchange of electric charges between the atoms. We may thus distinguish between two classes of chemical reactions, (1) those which do not necessarily require any interchange of the electrical charges carried by the atom, and (2) those which do.

When the discharge first passes through the vapour of ethylic alcohol, the spectrum on the positive side is the candle spectrum, that on the negative side the carbonic oxide spectrum. If the discharge is kept running for some time, the candle spectrum on the positive side is replaced by the carbonic oxide spectrum, which now occurs on both sides, accompanied on the negative side by the hydrogen spectrum. This appearance was observed in many other cases.

With hydrogen alone, a striking change is observed in the relative brilliancy of the red and green lines at the two electrodes. On the positive side the red line tends to be brighter than the green, whilst on the negative side the green line tends to be brighter than the red. On the negative side, we have an excess of positively charged hydrogen atoms, whilst on the positive side there is an excess of negatively charged hydrogen atoms, and the difference in the spectra may be partly attributed to the difference in properties between a positively and a negatively charged hydrogen atom. No difference could be detected between the spectra given by chlorine at the two electrodes.

H. C.

Velocities of the Ions. By W. C. Dampier Whetham (*Proc. Roy. Soc.*, 1895, **58**, 182—187).—The author has directly measured the velocities of the ions during electrolysis by using solid solutions in agar-agar jelly, tracing the motion of the ion by the formation of a precipitate. The following table gives the velocities of all ions which have been experimentally determined.

	Specific ionic velocity in cm. per second.	
	Calc. from Kohlrausch's theory.	Obs.
Hydrogen (in chlorides)........	0·0028	0·0026
,, (in acetates)	0·000048	0·000065
Copper	—	0·00031
Dichromate group (Cr_2O_7)......	0·00047	0·00047
Barium	0·00037	0·00039
Calcium......................	0·00029	0·00035
Silver	0·00046	0·00049
Sulphate group (SO_4)..........	0·00049	0·00045
Cobalt in alcoholic $CoCl_2$......	—	0·000022
,, ,, $Co(NO_3)_2$...	—	0·000044
Chlorine ,, $CoCl_2$......	—	0·000026
Nitrate group ,, $Co(NO_3)_2$...	—	0·000035

The sum of the ionic velocities of cobalt nitrate in alcohol, as calculated from the conductivity, comes out 0·000079, and that for cobalt chloride 0·000060. These numbers are to be compared with the sum of the observed velocities given above, namely, 0·000079 and 0·000048 respectively.

H. C.

Dissociation of Cyanides. By J. L. R. Morgan (*Zeit. physikal. Chem.*, 1895, **17**, 513—535).—By the determination of the E.M.F. of the following chains (1) $Ag \mid AgNO_3(N/10) - KNO_3(N/7) - KCl(N/1)$ $HgCl \mid Hg$; (2) $Ag \mid KAg(CN)_2\ (N/20) - KNO_3\ (N/1)$ – &c., and (3) $Ag \mid (KAg(CN)_2\ (N/20) + MCN) - KNO_3\ (N/1)$, &c., can be calculated the E.M.F. between (1) the $KAg(CN)_2$ (N/20) and the $AgNO_3$ (N/10), and (2) the $[KAg(CN)_2 + MCN]$ and the $AgNO_3$. Hence is obtained the ratio of the concentration of the silver ions in the two cyanide solutions, and from this ratio the concentration of the cyanide ions in the added cyanide, MCN. The dissociation of the double cyanide is shown to take place according to the scheme

$$KAg(CN)_2 \lessgtr \overset{+}{K} + Ag(\overset{-}{C}N)_2, \quad \overset{+}{K} + Ag(\overset{-}{C}N)_2 \lessgtr \overset{+}{K} + AgCN + \overset{-}{C}N$$

(to a smaller extent), and $AgCN \lessgtr \overset{+}{A}g + \overset{-}{C}N$ (to a very small extent), the concentration of the cyanide ions being about $2{\cdot}76 \times 10^{-3}$ N, and of the silver ions about $3{\cdot}65 \times 10^{-11}$ N in a N/20 solution. In other similar salts, as in $K_2Ni(CN)_4$, the dissociation is similar, whilst potassium ferrocyanide also contains CN-ions, but to a much smaller extent than the foregoing, and in ammonium thiocyanate solution there is present only a very small percentage of CN-ions. The dissociation constant of hydrogen cyanide is found to be $2{\cdot}6 \times 10^{-8}$, a number agreeing well with Van Laar's calculated value $3{\cdot}1 \times 10^{-8}$. The method is also available for the determination of solubilities, and that of silver cyanide is so found to be $3{\cdot}17 \times 10^{-7}$ at 17·5°. L. M. J.

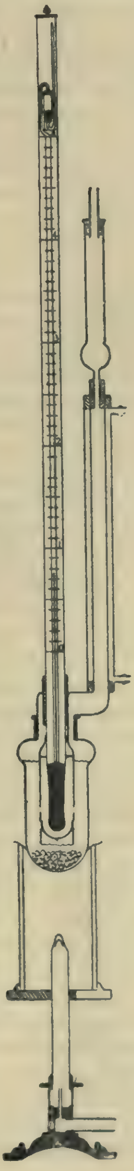
Flames. By Nicolae Teclu (*J. pr. Chem.*, 1895, [2], **52**, 145—160; compare Abstr., 1891, 1309; Trans., 1892, 204, 322; 1894, 603).—The author describes some variations of his original apparatus for dividing flames (Abstr., 1891, 1309) and the effects obtainable therewith. The principle involved in the construction of these apparatus has already been employed by Smithells and others.

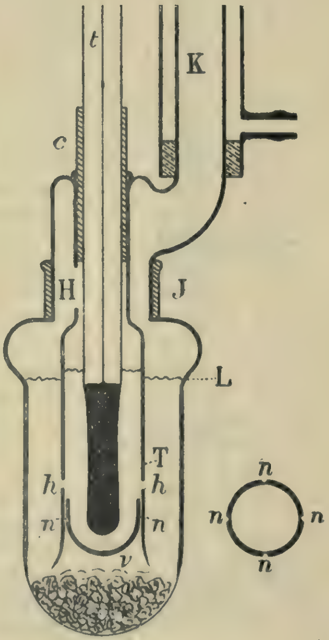
In considering the combustion of illuminating gas, it is essential to take into account two flames—that of carbonic oxide and that of hydrogen. Apart from its yellow colour, due to glowing carbon, an illuminating gas flame is blue; such a colour appertains solely to the carbonic oxide, which is abundantly present as a product of combustion, and to the hydrogen in the flame. When coal-gas is allowed to stream into the air, there exist between the latter and the burner two zones, one of unburnt gas, the other a mixture of the gas and air. When kindled, the mixture of gases becomes a mass of glowing carbon and burning carbonic oxide and hydrogen; the products of this combustion pervade the flame, and, together with atmospheric nitrogen, detract from its luminosity. These reactions are dependent on the extent of the flame surface and, therefore, on the size of the burner and on the rate of issue of the gas.

When a mixture of air and gas is allowed to issue from a burner, the reactions are dependent on the rate of issue of the gas; for a mixture of hydrogen with oxygen will burn much more rapidly than a mixture of carbonic oxide with an equivalent volume of oxygen.

In consequence of this, the lower flame will consist mainly of burning hydrogen, the upper of burning carbonic oxide. Rapidity of diffusion may determine the partial reversal of this state of affairs in a burner with a long mixing tube. The proportion of oxygen, of products of combustion, and of inert gases present, is a modifying agency.

Some remarks on the colour of flames concludes the paper. A. G. B.

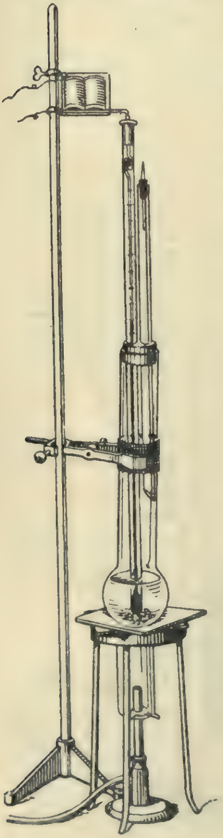




New Boiling-point Apparatus for Molecular Weight Determinations. By H. B. Hite (*Amer. Chem. J.*, 1895, **17**, 507—517).—The vessel, L, contains the solvent or solution, and in its lower part, to aid the boiling, are placed some glass beads, or, still better, some hollow balls, 3 mm. in diameter, of closely woven platinum gauze; it rests on a piece of wire gauze, supported on a piece of wide glass tubing, which serves as a chimney to the Bunsen burner used for heating; the flame should be a very small, smoky one. The vessel is closed by a ground glass stopper while the solvent is being weighed in it, but, during the determination, this is replaced by the ground stopper illustrated in the diagram. This on one side is prolonged into the condenser tube, K, through which the substance is introduced, and which at the upper end communicates with the air by means of a calcium chloride tube. In the centre, it is prolonged downwards into the tube T, which is closed at the lower end by the cup-shaped stopper sketched; this is ground to fit tightly for a length of 4—5 mm., and its upper (? lower) edge should be 20 mm. above the end of the tube T; three or four small vertical notches *n*, *n*, are filed on this stopper. The solution in the tube T communicates with that outside through the small holes *h*, *h*, and the vapour escaping from it passes through the hole H to the condenser. When the apparatus is working, vapour given off in bubbles at the bottom of the flask collects in the space *v*, and passes upwards through the notches *n*, *n*, in a series of small bubbles through the liquid in T, in which the bulb of the Beckmann thermometer is placed; this liquid is thus kept well stirred, and it is protected against superheating by the jacket of solution. It is claimed that the apparatus is simpler than Beckmann's, and gives better results; in experiments made with alcohol, ether, and benzene as solvents, the results of individual determinations never varied by more than 10, and seldom by more than 5, per cent. C. F. B.

New Boiling-point Apparatus for Molecular Weight Determinations.

By WILLIAM R. ORNDORFF and F. K. CAMERON (*Amer. Chem. J.*, 1895, **17**, 517—531).—The bulb-tube, which may be part of a V. Meyer vapour density apparatus, should be about 300 mm. long by 40 mm. in diameter, and is preferably of thin glass; it contains the solution, and its bottom is covered with pellets made by rolling together strips of scrap platinum; the use of 30—40 grams of these is suggested. The condenser is a plain tube of about 13 mm. diameter, with its lower end ground obliquely so as to return the condensed liquid down the sides of the bulb-tube; its upper end is closed by a piece of tubing with a capillary orifice or by a calcium chloride tube; when a low-boiling solvent is employed, this tube is lengthened and provided with a water-jacket. Slightly above the lower end of the condenser a strip of fine copper gauze, 4 cm. wide, is wound three or four times round the tube of the outer bulb, and is gripped by the bare metal of the clamp; this arrangement acts as a condenser, so that very little vapour condenses in the upper part of the tube. The tube rests on wire gauze placed over a circular orifice, 30—40 mm. in diameter, in a piece of thick asbestos cardboard, and is strongly heated so as to cause a rapid boiling of the solution. A Beckmann thermometer is used, and is tapped by an electric hammer made from a small electric bell with the gong removed; it is better that the thermometer should have a capillary tube of wider bore than is usual, although the



larger bulb thus necessitated is a disadvantage. The apparatus is less troublesome, and requires less time, to work than Beckmann's, and is especially useful for high-boiling solvents; experiments were made with carbon bisulphide, chloroform, benzene, toluene, pyridine, ethylenic bromide, anisoïl, phenetoïl, and naphthalene as solvents, and the results of individual determinations never differed by more than about 10 per cent., and were usually much less than this.

C. F. B.

Motions of and within Molecules; and on the Significance of the Ratio of the two Specific Heats in Gases. By G. JOHNSTONE STONEY (*Proc. Roy. Soc.*, 1895, **58**, 177—182).—We may distinguish the movements of molecules into three kinds of events.

1. A events; by which are to be understood motions of the centres of mass of the molecules relatively to one another.

2. Ba events; that is, events within a molecule which act on and are reacted on by a neighbouring molecule, if sufficiently near.

3. Bb events; more isolated events going on within molecules, events of the kind that manifest themselves conspicuously in phosphorescent substances, events which but slowly part with any excess of energy they may possess to the other events going on within the molecule, or to neighbouring molecules.

An event of the Bb class, which subsides so rapidly as to require the phosphoroscope to detect it, will behave, in any protracted experiment for determining the ratio of the two specific heats, in the same way as events of the Ba class. But this ceases to be the case where the ratio of the two specific heats is determined by experiments on sound; and in all the experiments which have been made use of it ceases to be the case when Bb events are as slow in subsiding as some of them are in conspicuously phosphorescent substances.

Now the method by which the ratio of the two specific heats has been determined for argon and helium has been by experiments on sound; and as the value furnished by this method depends on Ba events, it is competent to supply information about them only. It gives no information as to the energy involved in events of the Bb class. Accordingly it remains quite possible that Bb events may be easily evoked by stimulation of argon and helium, and that while in existence they may engross a considerable share of the total energy in the gas. That this is the case would seem to be evidenced by the vivid spectra which these gases exhibit under the influence of electricity. There appears, therefore, to be no ground for the supposition which has been sometimes entertained, that there is incompatibility between the two facts that have been observed—the fact that in these two gases the ratio of the two specific heats is near its maximum value, and the fact that these gases, when stimulated by electricity, furnish brilliant spectra.

If the molecule consists of but one chemical atom, there may be both Ba and Bb events going on within that so-called atom. If the molecule consist of two or more chemical atoms, a part of the Ba events may be motions of the centres of mass of these atoms relatively to one another. But this is not always the case: the bonding between the atoms that form the molecule may be such that there is but little of this relative motion. Accordingly, the ratio of the two specific heats being large does not necessarily imply that the molecule is monatomic. The inference involves the erroneous supposition that there are no events going on within the molecule, and few degrees of freedom in its motion. H. C.

Specific Heat of Superfused Salts. By LOUIS BRUNER (*Compt. rend.*, 1895, **121**, 60—61). The author has measured the specific heat of liquid sodium thiosulphate with the following results.

Temp.	Sp. heat.	Temp.	Sp. heat.
94—17°	0·584	55—16°	0·599
83—16	0·586	47—17	0·602
83—16	0·588	36—17	0·395
65—16	0·590	2—13	0·563

The maximum occurs at about the fusing point, 48°. H. C.

Heat of Formation of Sodium Acetylide. By ROBERT DE FORCRAND (*Compt. rend.*, 1895, **120**, 1215—1218).—Sodium acetylide is readily obtained by heating the metal to dull redness in a current of dry acetylene, but a considerable quantity of carbon separates at the same time, and remains mixed with the product. The volume of acetylene evolved by the action of water corresponds exactly with the weight of sodium as determined by titration. It follows that the acetylide contains no free sodium, nor any compounds such as Na_2H or C_2NaH, and the carbon is simply mixed with it. It alters rapidly and deliquesces when exposed to air, and also oxidises readily.

Dissolution in dilute sulphuric acid leads to the following results.

C_2 diamond + Na_2 sol. = C_2Na_2 sol. .... develops −9·76 Cal.
C_2 amorphous + Na_2 sol. = C_2Na_2 sol. .. „ −2·96 „

the values being somewhat lower than with calcium carbide.

C_2H_2 gas + Ca sol. = H_2 gas + C_2Ca sol. develops +50·85 Cal.
C_2H_2 gas + Na_2 sol. = H_2 gas + C_2Na_2 sol. „ +48·39 „
$\frac{1}{2}C_2H_2$ gas + Na sol. = H gas + CNa sol. „ +24·20 „

Correcting the last value for the heat of volatilisation of solid acetylene on the assumption that it is one-third of that of solid benzene, it becomes +22·65 Cal.

It would seem that the thermal value of the hydrocarbon function is about +23 Cal, which is lower than the alcoholic function of the tertiary alcohols, and differs from the latter about as much (+5·24 Cal.) as they differ from the primary alcohols (+3·98). The difference between primary alcohols and phenols is greater (+7 Cal.).

C. H. B.

Calorimetric Investigations. Heat Equivalents of the Amides and Anilides of Monobasic acids. By FR. STOHMANN and RAYMUND SCHMIDT (*J. pr. Chem.*, 1895, [2], **52**, 59—71).—The amides and anilides of some monobasic acids, chiefly fatty, have been investigated. Isomeric substances have practically the same heat equivalents, except that benzamide differs considerably from formanilide, as one would expect from the previously known cases of such isomerism. An homologous difference of CH_2 produces a difference of 156·6 in the heat equivalent, just as in the case of the acids themselves; as is commonly found, however, the difference between the propionic and acetic derivatives is distinctly greater than this number, and that between the acetic and formic derivatives very decidedly less. The heat equivalents of the amides and anilides are greater by 75·9 and 804·6 Cal. respectively than those of the corresponding acids. The heat equivalent of the change, acid + ammonia (gaseous) = amide + water is +15·2 Cal., and that of the change, acid + aniline (liquid) = anilide + water is +6·0 Cal. The actual experimental results are given below.

	Amide.		Anilide.	
	Heat equivalent.	Heat of formation.	Heat equivalent.	Heat of formation.
Formic	134·9	62·6	861·4	38·1
	(liquid)			
Acetic	282·7	77·8	1010·8	51·7
Propionic	439·8	83·7	1168·0	57·5
Butyric	596·1	90·4	1324·3	64·2
Isobutyric	596·0	90·5	—	—
Isovaleric	751·6	97·9	—	—
Lauric	1849·7	140·8	2578·4	114·1
Myristic	2160·6	155·9	2891·4	127·1
Palmitic	2472·9	169·6	3204·9	139·6
Benzoic	847·8	51·7	1576·3	25·2
[Ammonium formate	129·5	137·0]	—	—

C. F. B.

Phthalic Chloride and Phthalide. By Paul Rivals (*Compt. rend.*, 1895, **120**, 1218—1219). The heat of combustion of phthalic chloride is 804·69 Cal. at constant volume, and 804·41 Cal. at constant pressure, and the heat of formation of the liquid chloride from its elements is therefore +97·8 Cal.

$C_8H_4O_2Cl_2$ liq. + $2H_2O$ liq. = $C_8H_6O_4$ sol. +
2HCl gas .... develops +2 Cal.

This value is very different from that obtained with benzoic chloride or toluic chloride. Moreover, the heats of formation of solid benzene, benzoic acid, and phthalic acid show a regular increase, but no such sequence obtains with liquid benzene, benzoic chloride, and phthalic chloride. It would seem, therefore, from thermochemical as well as purely chemical considerations, that phthalic chloride is not the symmetrical chloride of a dibasic acid, but a dissymmetrical isomeride. It is possible that phthalic chloride, like succinic chloride, may be a mixture of the two isomerides.

The heat of combustion of phthalide is 883·87 Cal. at constant volume, and 884·15 Cal. at constant pressure, and its heat of formation in the solid state is +77·25 Cal. No regular order is observed between the heats of formation of benzene, benzaldehyde, and phthalide.

The heat developed by the substitution of chlorine for hydrogen in phthalide, with production of phthalic chloride 32·3 × 2 Cal. is comparable with that developed by the substitution of chlorine for hydrogen in the paraffin series. C. H. B.

Campholenic Lactones (Olides). By Marcellin Berthelot and Paul Rivals (*Compt. rend.*, 1895, **120**, 1390—1391).—The inactive campholenic lactone, prepared by Béhal, and melting at 30°, has a heat of combustion at constant pressure of +1351·2 Cal., and its heat of formation from its elements is +143·8 Cal.; for the dextrogyrate lactone the corresponding values are +1354·1 Cal. and +140·9 Cal. respectively, the difference between the two compounds being not greater than the experimental error.

It is noteworthy that the heat of formation of these lactones is distinctly higher than that of the campholenic acids, with which they are isomeric; the difference between the inactive lactone and the liquid campholenic acid is +12·1 Cal. C. H. B.

Calculation of the Heat of Dissolution. By J. J. van Laar (*Zeit. physikal. Chem.*, 1895, **17**, 545—549).—The author considers that owing to the change of the dissociation constant by the dissolution of a quantity ds of the dissolved substances (s being the gram molecules of the substance present in 1 gram molecule of the solvent), a correction must be applied to the expression deduced by Rudolphi (this vol., ii, 435); whilst the same applies to the expression employed by van't Hoff (*Zeit. physikal. Chem.*, **17**, 147). By making this correction, the value $L = W + a/2 - a Q$ is obtained instead of $L = W + \alpha/Q$, and the values for the heat of solution in the cases examined by Rudolphi are recalculated. L. M. J.

Calculation of the Heat of Dissolution. By Hans Jahn (*Zeit. physikal. Chem.*, 1895, **17**, 550—551).—The values obtained by Rudolphi are recalculated by the author employing a somewhat different expression, the heat developed being given by the formula $L = - T^2/(C_1 + C_2) (dC/dT + 2C_2/dT)$. L. M. J.

Heat of Dissolution and Neutralisation of Campholenic acids. By Marcellin Berthelot (*Compt. rend.*, 1895, **120**, 1392).—The heat of neutralisation of the liquid campholenic acid is +13·2 Cal., and it behaves as a normal monobasic acid; its heat of dissolution in water is very small. The heat of neutralisation of the solid acid is also +13·2 Cal., and it likewise behaves as a normal monobasic acid; its heat of dissolution is −3·2 Cal.

The heat of neutralisation of campholic acid is between +10 and +15 Cal., and is probably normal; the heat of dissolution of the solid acid in sodium hydroxide solution is +10·0 Cal. C. H. B.

Wyrouboff's Racemate. By JACOBUS H. VAN'T HOFF and HEINRICH GOLDSCHMIDT (*Zeit. physikal. Chem.*, 1895, **17**, 505—512).—The authors first verified Wyrouboff's statements concerning the formation of the double racemate of potassium and sodium from a mixture of + and − tartrates at a temperature of about −6°. The transition temperature of a mixture of single racemates was next obtained by both thermometric and dilatometric methods; and also by the thermometric and tensimetric methods, the transition temperature from the mixture of the + and − racemates to the single racemates. The results obtained were as follows.

$$2(C_4H_4O_6NaK,4H_2O) = (C_4H_4O_6NaK,3H_2O)_2 + 2H_2O;\ -6^\circ.$$
$$2(C_4H_4O_6NaK,3H_2O)_2 = (C_4H_4O_6Na_2)_2 + (C_4H_4O_6K_2,2H_2O)_2 + 8H_2O;\ 41^\circ.$$
$$4(C_4H_4O_6NaK,4OH_2) = (C_4H_4O_6Na_2)_2 + (C_4H_4O_6K_2,2H_2O)_2 + 12H_2O;\ 33\text{—}34^\circ.$$

The results are seen to be closely analogous to those found with Scacchi's salt. (This vol., ii, 380). L. M. J.

Racemism, and Changes of Temperature on Mixing Liquids. By ALBERT LADENBURG (*Ber.*, 1895, **28**, 1991—1995).—In his previous paper (this vol., i, 253), the author did not assume, as is stated by E. Fischer (*Ber.*, **28**, 1153), that it is sufficient proof of the racemic nature of a compound when development or absorption of heat takes place on mixing the two optically active isomerides to form an inactive substance, but that if a change of temperature occurs without a simultaneous alteration in the specific gravity, the conclusion may be drawn that a racemic derivative is formed, and not merely an inactive mixture of the two components. To this statement, the author still adheres, and, in confirmation of the supposition, he finds from a number of experiments, details of which are given, that when two substances of approximately the same specific gravity, and having no chemical action on each other, are mixed, scarcely any change of temperature occurs, whilst if the specific gravity of the two liquids differs, considerable changes of temperature are observed, these becoming greater as the differences in the specific gravity of the two substances increases; the specific gravity of the mixture then always differs considerably from that calculated from the specific gravity of the components.

The author has confirmed the fall of temperature which takes place when equal quantities of dextro- and lævo-coniïne are mixed, but finds that no change of temperature occurs when dextro- and lævo-limonene are mixed, and therefore the resulting dipentene is not a racemic derivative, but simply an inactive mixture of the two components. H. G. C.

Determination of the Specific Gravity of Solids. By THE EARL OF BERKELEY (*Min. Mag.*, 1895, **11**, 64—68).—An ordinary pyknometer with a thermometer stopper and a side capillary tube is used. The principle of the method consists in waiting until the evaporation at the stopper brings down the level of the enclosed liquid (carbon tetrachloride) to the mark on the side tube, the temperature being noted at the time of weighing; the capacity of the pyknometer and the density of carbon tetrachloride having been previously determined for different temperatures and plotted on curves. The results are accurate to one part in 2000. L. J. S.

The Vapour Pressure of the Combined Water in Copper Sulphate and Barium Chloride. By WILHELM MÜLLER-ERZBACH (*Zeit. physikal. Chem.*, 1895, **17**, 446—458).—By the comparison of the loss of weight by evaporation from hydrated salts and pure water under similar conditions, the vapour pressure of the combined water in the former is calculable. In certain cases, however, as in copper sulphate and barium chloride, the results thus obtained do not agree among themselves, nor with the results according to the statical method. The author has therefore repeated and re-examined the evaporation experiments, and as the ratio of the evaporation remains constant for different pressures he concludes that the action is not merely a surface action as Tammann supposed. Different samples of copper sulphate, although apparently chemically identical, were found to give different initial values and to take different times before attaining their maximum value. By allowing the salts examined to become fully hydrated in damp air and again taking the measurements, concordant results are, however, obtainable, and by this means the author obtained satisfactory values for the salt examined. The ratio of the vapour pressure of copper sulphate to that of water was in this way found to be 0·25 at 12°, and that of barium chloride 0·15 at 13°, numbers agreeing satisfactorily with those given by the statical method. L. M. J.

Volume of Salts in their Aqueous Solutions. By PAUL E. LECOQ DE BOISBAUDRAN (*Compt. rend.*, 1895, **120**, 1190—1192).—The changes of volume which accompany dissolution may sometimes with advantage be directly determined in a dilatometer, consisting of a flat-bottomed flask of 75 to 125 c.c. capacity with a somewhat large neck, fitted with a good cork carrying a graduated tube of small diameter. The finely powdered salt, in a constant state of hydration, is placed in a tube of convenient height closed at one end, and covered with recently boiled petroleum of sp. gr. about 0·82. Recently boiled water is placed in the flask, the tube containing the salt is introduced, and the flask is filled up with more of the same petroleum. When the temperature is constant, the position of the petroleum in the graduated tube is read off, the salt in the small tube is brought in contact with the water, and after dissolution is complete and the temperature is the same as before, the position of the petroleum is again read off. By operating in this way, any traces of air adhering to the salt are somewhat rapidly dissolved by the boiled water and petroleum.

By comparing the results obtained by the dilatometer with those obtained by the ordinary bottle method, the true sp. gr. of the salt can be calculated. If V be the volume of the salt according to its provisional sp. gr., *w* the true volume corresponding with the true sp. gr.,

p the true percentage change of volume compared with the true volume of the solid, the volume of the water being regarded as constant, M the percentage change of volume by the bottle method, on the basis of the provisional sp. gr., and N the percentage change of volume by the dilatometer method, also on the basis of the provisional sp. gr. Then, by the bottle method, $w + \frac{wp}{100} - V$ is the change of volume referred to the provisional sp. gr., and hence

$$V : w + \frac{wp}{100} - V :: 100 : M \text{ and } w = \frac{100V + MV}{100 + p}.$$

With the dilatometer $V : \frac{wp}{100} :: 100 : N$,

and hence $$p = \frac{100N}{100 + M - N}.$$

The two methods control one another, and the author finds for the sp. gr. of sodium thiosulphate, $Na_2S_2O_3 + 5H_2O$, 1·751, and for sodium acetate, $NaC_2H_3O_2 + 3H_2O$, 1·448. C. H. B.

Volumes of Salts in their Aqueous Solutions. By PAUL E. LECOQ DE BOISBAUDRAN (*Compt. rend.*, 1895, **121**, 100—102).—The dilatation which occurs when ammonium chloride and other ammonium salts are dissolved in water at the ordinary temperature, is usually regarded as an anomaly due to the peculiar constitution of these compounds. It is, however, quite possible that the ammonium salts merely occupy one extreme end of a series, at the other extremity of which may be placed those salts which cause the greatest contraction. When a salt is dissolved in water, the accompanying volume change is made up principally (1) of the dilatation caused by the fusion of the salt without decomposition at the temperature of the experiment, and (2) of the contraction due to the combination of the salt with the solvent, this combination becoming more marked the more dilute the solutions and the lower the temperature. In keeping with these views, the author finds that ammonium chloride always causes a dilatation on solution in water at 15°, but that at 0° there is a slight contraction for very dilute solutions. And sodium thiosulphate, which causes an enormous contraction at 15° in dilute solution, produces dilatation in very concentrated solution. H. C.

Osmotic Phenomena between Ether and Methylic Alcohol with Different Diaphragms. By FRANÇOIS M. RAOULT (*Compt. rend.*, 1895, **121**, 187—189).—The osmometer used by the author consists of a cylindrical box of bronze, divided by means of a permeable partition into two compartments, each of 100 c.c. capacity, and each communicating with a vertical manometer tube. When the two compartments are filled with different liquids, osmose takes place as a rule, and passage of the one liquid into the other through the permeable partition; then the liquid sinks in one of the manometer tubes, and rises in the other. In the experiments recorded the liquids used were ether and methylic alcohol. If the permeable diaphragm is one of pig's bladder, osmose, that is passage of liquid, takes place,

1. From methylic alcohol into pure ether;
2. From methylic alcohol into a mixture of one-fifth ether and four-fifths methylic alcohol;
3. From a mixture of one-fifth methylic alcohol and four-fifths ether into pure ether.

The diaphragm behaves as if impermeable to ether and permeable to methylic alcohol, and the velocity of the passage of the alcohol through the diaphragm is inversely proportional to the quantity of ether previously mixed with the alcohol. If the permeable partition is one of vulcanised india-rubber, 1 mm. in thickness, osmose takes place in the reverse sense, and a passage of liquid,

1. From pure ether into methylic alcohol;
2. From a mixture of one-fifth ether and four-fifths methylic alcohol into pure methylic alcohol;
3. From pure ether into a mixture of one-fifth methylic alcohol and four-fifths ether.

The vulcanised india-rubber diaphragm behaves, therefore, as though impermeable to methylic alcohol and permeable to ether. A measurement of the pressure which this osmose is capable of producing presents great difficulty, and the author has only been able to establish the fact that it is very considerable. A mixture of equal volumes of ether and methylic alcohol was separated from pure ether by means of an india-rubber diaphragm. Osmose took place, and the pressure on the side of the mixture rose to 50 atmos. without any apparent decrease in the velocity of the osmose. Fracture of the manometer prevented further measurement.

The experiments show that osmose between two liquids may not only vary in energy, but even change in sense with change in the character of the diaphragm, and that the osmotic movement of substances through a diaphragm may be perfectly independent of their molecular weights, or of their character as dissolved substances or solvents. H. C.

Determination of Isosmotic Concentrations. By H. Köppe (*Zeit. physikal. Chem.*, 1895, **17**, 552—553).—The differences between the results of Hedin (this vol., ii, 381) and those of the author are regarded as due to the fact that the solutions actually examined are not the solutions added, but are these diluted by the plasma of the blood. L. M. J.

Water of Crystallisation. By Theodor Salzer (*Ber.*, 1895, **28**, 2033—2038; compare Abstr., 1894, ii, 416).—The author adduces evidence in support of the regularities to which he has already drawn attention (*Annalen*, 1886, **233**, 1), underlying the phenomena of water of crystallisation. M. O. F.

Solubility of Superfused Salts. By Louis Bruner (*Compt. rend.*, 1895, **121**, 59—60).—According to Walker (Abstr., 1890, 686), the curves for the solubility of the same substance in the liquid and solid states cut one another at the melting point. The solubility of the solid substance above the fusing point will be greater than that of the liquid, below the fusing point it will be less. The latter condition is the only one that can be realised in practice. The author has compared the solubilities of solid and of superfused sodium thiosulphate in alcohol; he finds, in keeping with the above, that the superfused salt has the greater solubility. H. C.

Solubility of Benzene Derivatives in Water. By Wilhelm Vaubel (*J. pr. Chem.*, 1895, [2], **52**, 72—75).—A table of the solubility of a number of aromatic substances is given, and the following general inferences are drawn. "The solubility of these substances is conditioned by the presence of an amido, hydroxyl, or carboxyl group. The 'dissolving force' (*lösende Kraft*) of these is weakened by the presence of substituting groups, such as methyl, bromine, iodine, and the nitro-group. The methyl group lowers the solubility most when it is in the para-, least when in the ortho-, position, and the same holds for the nitro-group, bromine, and iodine, in the substituted benzoic acids. In the amido- and hydroxy-derivatives, on the other hand, the influence of the nitro-group is greatest in the ortho-, least in the meta-, position. In the case of isomeric derivatives, the meta-substituted compound has the greatest, the para-substituted the least, solubility." In the case of aniline, the solubility is increasingly diminished by the successive replacement of the two amido-hydrogen atoms by alkyl groups. Carnelley and Thomson's rule, that for isomeric organic compounds the order of solubility is the same as the order of fusibility, does not hold. C. F. B.

Solubility of Carbon Compounds in Carbon Bisulphide at Low Temperatures. By Henryk Arctowski (*Compt. rend.*, 1895, **121**, 123—125).—The author has determined, by Étard's method, the solubility of various substances in carbon bisulphide at low temperatures. The melting point of the bisulphide is $-115°$; the results are stated in grams of the substance contained in 100 grams of the saturated solution at the specified temperature. Mercuric iodide, 0·017 at $-116°$; iodine, 0·378 at $-94°$; sulphur, 2·99 at $-116°$; stannic iodide, 9·41 at $-114·5°$; bromine, 36·9 at $-116°$; phthalic anhydride, 0·016 at $-77·5°$, 0·013 at $-93°$, 0·013 at $-112·5°$; triphenylmethane, 1·91 at $-83°$, 1·56 at $-91°$; 1·24 at 102°, 0·98 at $-113·5°$; diphenylamine, 0·87 at $-88·5°$, 0·37 at $-117°$; naphthalene, 1·38 at $-82°$, 1·05 at $-89·5°$, 0·62 at $-108·5°$.

These results show that not only does the solubility not become zero at the freezing point of the solvent, as Étard has concluded, but the curves of solubility do not tend towards the same point, and do not tend to cut the axis of temperatures, but are asymptotic with it. C. H. B.

Molecular Symmetry and Asymmetry. By Albert Ladenburg (*Ber.*, 1895, **28**, 1995—1997).—It is usually supposed that when the molecule of a substance contains no plane of symmetry, the subtance is capable of existing in two enantimorphic forms, each being the reflected image of the other. The author points out that there are certain exceptions to this rule, namely, such substances as contain a pseudo-plane of symmetry, that is a plane which divides the molecule into two parts, one of which has the same relation to the other as an object to its image in a plane mirror. In such cases, the image of the whole molecule is also identical with the object, and therefore no enantimorphic forms are possible. H. G. C.

Calculation of Affinity Constants. By MAX RUDOLPHI (*Zeit. physikal. Chem.*, 1895, **17**, 385—426).—In the case of many acids and salts, the dilution law for the dissociation is not obeyed, that is, the expression $(\lambda_v/\lambda_\infty)^2/v(1-\lambda_v/\lambda_\infty)$ does not lead to a constant (k). Thus, for silver nitrate, $k_{16} = 0{\cdot}26$, $k_{64} = 0{\cdot}13$, $k_{256} = 0{\cdot}065$, numbers which evidently indicate the constancy of $k\sqrt{v}$, that is, of $(\lambda_v/\lambda_\infty)^2/\sqrt{v}(1-\lambda_v/\lambda_\infty)$. The value of this expression is therefore determined for a large number (128) of salts and acids, and is found to be dependent on the nature of the electrolyte and solvent, but independent of volume and temperature. Analogous salts of similar elements have approximately the same constant; this result also obtains for analogous acids. Chlorides, bromides, iodides, fluorides, and nitrates have a similar constant, as have carbonates and sulphates, whilst in all cases the constant of the acid is greater than that of the corresponding salts. L. M. J.

The Influence of Centrifugal Force on Chemical Systems. By GEORG BREDIG (*Zeit. physikal. Chem.*, 1895, **17**, 459—472).—If a gas be enclosed in a rotated tube then the variation of pressure is given by the equation $dP/P = 4\pi^2n^2r^2Mdr/RT$, where r is the radius of rotation, n the number of turns per second, and M the molecular weight of the gas. From this, can be readily derived that if a mixture of two gases be rotated, their *relative* molecular concentrations (c_1 and c_2) at radii r_1 and r_2 are given by the equation $\log(c_1/c_2) = (r_1^2 - r_2^2)(M' - M'')2\pi^2n^2/RT$, so that the relative concentration of the gas of higher molecular weight increases with the radius of rotation. A tube consisting of two portions connected by means of a stopcock was therefore filled with a mixture of hydrogen and hydrogen iodide, and was rapidly rotated for from $1\frac{1}{2}$ to 3 hours when it was stopped, and the stopcock immediately closed. Owing to the stoppage, the sum of the partial pressures will now be equal in the two halves of the tubes, but the relative concentrations will not have been greatly altered, and the ratio of the partial pressure of the hydrogen in the two halves can be theoretically obtained. It was experimentally determined by the absorption of the hydrogen iodide in each part by a potash solution, the values so obtained, 0·970, 0·975, and 0·972, agreeing very satisfactorily with the calculated numbers 0·986, 0·979, and 0·982. The effect of centrifugal force on a system in equilibrium is also considered, and the result obtained that, although the density of the system increases with the radius, the equilibrium constant is not altered. The author points out that water in a rotated tube would distil to the far end owing to the diminution of the density of the vapour at the nearer end, and discusses shortly the compensation effect due to temperature difference consequent on the evaporation and condensation. L. M. J.

Precipitates in Gelatinous Solutions. By NATHANAEL PRINGSHEIM (*Zeit. physikal. Chem.*, 1895, **17**, 473—504).—A graduated tube was filled with gelatin and placed horizontally in communication with two vessels containing liquids capable of forming a precipitate. After a time, owing to diffusion, a precipitate is formed within the gelatin, and this precipitate, it is observed, may increase in thickness towards either side, but not towards both, the direction in which the increase takes place depending on the concentrations of the solutions. In some cases, the increase ceases shortly after the formation of the precipitate, and in experiments with potassium chloride—silver nitrate, barium chloride—silver nitrate, potassium ferrocyanide—copper sulphate, potassium dichromate—lead acetate, the limited increase occurred when the solutions were at, or nearly at, equivalent concentrations. If the concentrations were not nearly equivalent, unlimited increase took place on the side of the solution of lower concentration. The author also observed a slight movement of the precipitate shortly after its formation, and this motion is proved to be real, and not an apparent motion due to contraction or expansion of the gelatin. It was found to be independent of the concentration of the solutions and to depend only on their nature, being in the cases examined in the directions $AgNO_3 \rightarrow KCl$; $CuSO_4 \rightarrow K_4FeC_6N_6$; $K_4FeC_6N_6 \rightarrow ZnSO_4$, and $Pb(C_2H_3O_2)_2 \rightarrow K_4FeC_6N_6$. A list of the diffusion velocities in the cases examined is also added, and the foregoing results, and the question of the use of these precipitates in osmotic experiments are shortly discussed. L. M. J.

Systematic Arrangement of the Elements. By JULIUS THOMSEN (*Zeit. anorg. Chem.*, 1895, **9**, 190—193).—The author arranges the elements in ascending order of atomic weights in three main groups, of which the first contains two series of seven elements, the second two series of 17 elements, and the third 31 elements. Hydrogen stands by itself. Electropositive elements are at the one end of each of the four smaller series and electro-negative elements at the other. The arrangement serves to show relationships between the elements beyond those shown by the ordinary periodic scheme. E. C. R.

Methods of Physico-chemical Measurements. By WILHELM OSTWALD (*Zeit. physikal. Chem.*, 1895, **17**, 427—445).—The author briefly reviews and discusses the aims and methods of physical chemistry. L. M. J.

A Gas Furnace. By C. BIGOT (*Zeit. anal. Chem.*, 1895, **34**, 447—448; from *Mon. sci.*, **37**, 519).—This furnace, which is capable of giving any desired temperature up to one exceeding the melting point of porcelain, with either a reducing or oxidising atmosphere, is heated by a ring of bunsen burners, from which the gas, passing

into the interior of an outer chamber, there meets air heated by entering round the flue. The products of combustion then pass downwards through an inner chamber, where the object to be heated is situated, and escape by a descending flue to a chimney. A figure is given.
M. J. S.

Inorganic Chemistry.

Occlusion of Oxygen and Hydrogen by Platinum Black. By Ludwig Mond, William Ramsay, and John Shields (*Proc. Roy. Soc.*, 1895, **58**, 242—243; and *Zeit. anorg. Chem.*, **10**, 178—180).—The authors describe experiments on the occlusion of oxygen and hydrogen by platinum sponge and foil which confirm the results obtained by Graham.

Platinum black dried at 100° contains 0·5 per cent. of water, and this can only be removed in a vacuum at about 400°, at which temperature the black is converted, at least partially, into sponge. At any given temperature, the water retained by platinum black seems to be constant. The density of platinum black dried at 100° is 19·4, or, allowing for the water retained by it, 21·5. Platinum black contains altogether about 100 volumes of oxygen; this begins to come off in quantity at 300° in a vacuum, and the bulk of it can be extracted at 400°, but a red heat is necessary for its complete removal. Small quantities of carbonic anhydride are also extracted, chiefly between 100—200°. About 310 volumes of hydrogen are absorbed per unit volume of platinum black, but of this 200 volumes are converted into water, and only 110 volumes are really occluded by the platinum. Part of it can be again removed at the ordinary temperature in a vacuum, and by far the larger portion at about 250—300°, but a red heat is necessary for its complete removal. The amount of hydrogen absorbed by platinum is very largely influenced by slight traces of impurity.

Platinum black in a vacuum absorbs a certain quantity of hydrogen, and on increasing the pressure to about 200—300 mm. a further quantity is absorbed. After this, however, pressure is almost without effect, for by increasing the pressure from one atmosphere to $4\frac{1}{2}$ atmospheres, only one additional volume of hydrogen was absorbed. On placing platinum black, charged with oxygen, in an atmosphere of oxygen, and increasing the pressure to the same extent, $8\frac{1}{2}$ volumes were absorbed. Platinum black, charged with hydrogen, in an atmosphere of hydrogen at atmospheric pressure and platinum black, charged with oxygen, in an atmosphere of oxygen behave quite differently when heated. In the former case, hydrogen is expelled, whilst in the latter case oxygen is gradually absorbed until a temperature of 360° is reached, when, on further heating, oxygen begins to come off.

The authors point out that there is not sufficient evidence for the existence of such compounds as $Pt_{30}H_3$ and $Pt_{30}H_2$. Moreover, the heats of combination of hydrogen and platinum as determined by Berthelot and Favre are valueless; the heat which they measured is due to the formation of water by the oxygen always contained in platinum black. E. C. R.

Properties of Ozone, and of Oxygen in presence of Sunlight. By J. ADOLPHE BESSON (*Compt. rend.*, 1895, **121**, 125—128).—When tetrachlorethylene is exposed to light in presence of excess of oxygen, it is converted into trichloracetic chloride and carbonyl chloride, the action being more rapid under slightly increased pressure. The same products are formed by the action of ozone (Abstr., 1894, i, 481). No compound such as $(CCl_2)_2O$ seems to be formed. This result explains the apparently complete oxidation of tetrachlorethylene by hydrogen peroxide under the influence of sunlight; the final products result from the action of the water on the direct oxidation products of the tetrachlorethylene.

Phosphorus trichloride is completely converted into phosphorus oxychloride when exposed to sunlight in presence of oxygen.

Phosphorus tribromide, when heated with a current of ozonised oxygen, is converted into phosphorus pentabromide and phosphorous anhydride, and no oxybromide is formed. The same products are obtained when the tribromide is exposed to light in presence of excess of oxygen.

Ozonised oxygen converts arsenic trichloride into arsenic anhydride mixed with a little arsenious anhydride. Oxygen in presence of sunlight, on the other hand, has no action on arsenic trichloride, and ozonised oxygen has no action on cold solutions of phosphorus pentachloride or pentabromide in carbon tetrachloride.

Ozonised oxygen, and oxygen in presence of sunlight, act on solutions of phosphorus diiodide and triiodide in carbon bisulphide at $-20°$ to $-5°$, with liberation of iodine and formation of complex products containing phosphorus, iodine, and oxygen. C. H. B.

Spontaneous Decomposition of Thiosulphuric acid. By ARNOLD F. HOLLEMAN (*Rec. Trav. Chim.*, 1895, **14**, 71—81).—If the spontaneous decomposition of thiosulphuric acid really takes place in accordance with the unimolecular equation $H_2S_2O_3 = H_2O + SO_2 + S$, the rate of the action should be greatest at the outset, when the concentration is at a maximum, but this, at first sight, does not appear to be the case.

The hypothesis proposed by Spring to account for the interval that elapses between the addition of an acid to a solution of a thiosulphate and the consequent precipitation of sulphur, namely, that the sulphur results from the interaction of hydrogen sulphide and sulphurous anhydride produced by secondary action, is untenable, for the precipitation may be effected in the presence of a lead salt without the formation of a trace of lead sulphide.

The only secondary action that might serve to retard the precipitation is that due to the formation of trithionate by the action of liberated sulphurous acid on undecomposed thiosulphate, but this does not take place to any extent, as the acidity of the product diminishes only very slowly.

The true explanation of the slow appearance of the sulphur is that it is formed from the commencement, but takes time to form visible aggregates. That this is the case is proved by neutralising the mixture of acid and thiosulphate before the formation of any turbidity; the sulphur still appears after the usual interval. The rate of diminution of the thiosulphate also, as determined by iodine titration, steadily diminishes with the time, as required by the unimolecular equation.

The instability of thiosulphuric acid may be accounted for on two hypotheses. According to Ostwald, the hydrogen ions exercise a reducing action on the S_2O_3 ions, whilst, according to the author, it is the undissociated molecules of thiosulphuric acid which split up. If the latter view is correct, the equilibrium between the undecomposed molecules and the free ions must be maintained by the reunion of ions, leading to the retardation and ultimate stoppage of the action at the dilution at which the ions will no longer unite, and the constant K in the equation $-dC/dt = KC$ will vary in the same sense as the concentration C, whilst, if the former view is correct, the constant and the concentration will vary in opposite senses. Actual measurement of the constant at various concentrations show that the two vary in the same sense.

The decomposition of thiosulphuric acid thus takes place in accordance with the equation $H_2S_2O_3 = H_2O + SO_2 + S$, in which the undissociated molecules, and not the ions, take part.

The molecular conductivity of sodium thiosulphate is $\mu_\infty = 128$, from which the velocity of the ion $S_2O_3/2 = 78{\cdot}8$; Brédig's value, deduced from the conductivity of magnesium thiosulphate, is 91. The molecular conductivity of thiosulphuric acid is $\mu_{32} = 274{\cdot}6$, or of the same order as that of sulphuric acid. JN. W.

Composition of Extinctive Atmospheres produced by Flames. By FRANK CLOWES (*Proc. Roy. Soc.*, 1895, **57**, 353—357).—Following on the results obtained by mingling gases which are extinctive of flame with air, until a flame burning in the mixed atmosphere was just extinguished (this vol., ii, 443), the author now describes a series of experiments to determine the composition of the atmosphere extinctive of each flame, which is produced by the flame itself when burning in an inclosed volume of air at atmospheric pressure. To obtain trustworthy results, it is necessary that the atmosphere should not be in contact with water, and, moreover, the pressure in the inclosed atmosphere must be constant during the combustion of the flame. For this purpose a bell-jar is employed, the bottom of which dips into a vessel of mercury. The neck is closed by a cork having a U-shaped mercury gauge and a glass tube with a stop-cock. While the flame is burning, the pressure of the air within the bell-jar is maintained uniform by raising or lowering the jar sufficiently to maintain the mercury levels unchanged in the pressure gauge. The composition of the residual atmospheres after the flame has burnt out, agree very fairly with the composition of the artificial atmospheres consisting of nitrogen and oxygen only, in which the flames are just extinguished when they are inserted.

The author points out that the composition of the extinctive atmosphere produced by the flame of a candle, or of oil or alcohol, which contains 15—16 per cent. of oxygen, 80—81 per cent. of nitrogen, and 3 per cent. of carbonic anhydride, closely corresponds with the average composition of air expired from the lungs. This air can be breathed by most people without producing any distinctly noticeable effect, a result which agrees with the statements made by experienced mining authorities.

The residual atmosphere produced by the hydrogen flame is undoubtedly not respirable, on account of the greatly diminished proportion of oxygen which it contains. The colour of the hydrogen flame undergoes a change of colour from reddish-purple to blue as the proportion of oxygen in the atmosphere is diminished. A similar change is noticed when carbonic anhydride is present in the atmosphere; it is probably due to the lowering of temperature of the flame. All attempts have failed to detect the production of carbonic oxide by this flame, when it is burning in air containing carbonic anhydride. E. C. R.

Combination of Nitrogen with Carbon and Sulphur. By MARCELLIN BERTHELOT (*Compt. rend.*, 1895, **120**, 1315—1316).—When electric sparks are passed through a mixture of nitrogen and carbon bisulphide vapour at about 20°, sulphur and carbon are precipitated and the nitrogen is slowly absorbed. A small quantity of mercuric thiocyanate is formed, but the greater part of the nitrogen is converted into more highly condensed products. With the silent discharge in place of sparks, there is no precipitation of carbon, and after some time the nitrogen is completely absorbed. There is no fluorescence such as is observed in the case of argon and benzene. If the product is heated, some carbon bisulphide is regenerated and nitrogen is liberated, but the volume of the latter is much smaller than that of the original gas. C. H. B.

Reduction of Nitrous Oxide by Metals in presence of Water. By PAUL SABATIER and J. B. SENDERENS (*Compt. rend.*, 1895, **120**, 1212—1215).—Well-washed nitrous oxide, when allowed to remain in contact with moist iron turnings over mercury, is slowly reduced to nitrogen, some hydrogen being also liberated. An aqueous solution of the gas is also reduced by iron, magnesium, zinc, and cadmium, with production of nitrogen and hydrogen, the latter being derived from the water in presence of the small quantity of ammonia that is formed. No hydrogen is, however, liberated when cadmium is the reducing agent. The iron becomes converted into hydrated ferrosoferric oxide, which, after being dried, is highly magnetic (compare this vol., ii, 445). C. H. B.

Action of Nitric Oxide on Metallic Chlorides. By V. THOMAS (*Compt. rend.*, 1895, **121**, 128—130).—When ferric chloride is subjected to the prolonged action of nitric oxide (see this vol., ii, 271) at a temperature of 60—100°, and the product is afterwards heated in sealed tubes at about −175°, a red compound, $5Fe_2Cl_4,NO$, is obtained; this is very hygroscopic, and decomposes very rapidly when exposed to air. When heated in an inert gas, it yields pure ferrous chloride. Another compound, Fe_2Cl_4,NO, with similar properties, is obtained as a brownish-yellow powder by heating ferric chloride in a current of nitric oxide in a porcelain tube to which a long glass tube is attached. The compound sublimes readily and condenses in the glass tube; in composition it is identical with the product of the action of nitrogen oxides on a solution of ferrous chloride at 12·5—25°.

Bismuth chloride rapidly absorbs nitric oxide, and yields a yellow compound, $BiCl_3,NO$; aluminium chloride is slowly converted into a pale yellow compound, Al_2Cl_6,NO. Both products are extremely hygroscopic and decompose rapidly when exposed to air. When heated in sealed tubes, they melt without decomposing (compare Besson, Abstr., 1889, 834). C. H. B.

Mutual Behaviour of Hydrogen Peroxide and Nitrous acid in very dilute Solutions. By LUDWIG ILOSVAY DE NAGY ILOSVA (*Ber.*, 1895, **28**, 2031—2032).—The author has arrived at the following conclusions.

1. One part of hydrogen peroxide per million is not completely reduced in acid or neutral solution after remaining in contact with the calculated amount of nitrous acid for 45—50 hours; the greater the excess employed above this quantity, however, the more rapid is the reduction, and when an acid solution containing 15 times, or a neutral solution containing 20 times, the theoretical quantity is employed, hydrogen peroxide can no longer be detected in the liquid.

2. When an acid solution of nitrous acid containing one part per million remains in contact with the calculated amount of hydrogen peroxide for 50—60 hours, it still exhibits feeble indications of the presence of nitrous acid, whilst in neutral solution nitrous acid is easily detected. The rapidity with which oxidation takes place is increased on augmenting the quantity of hydrogen peroxide, but not in any definite proportion. In order to oxidise an acid solution of nitrous acid containing one part per million, vigorous agitation with 800 times the calculated amount of hydrogen peroxide is necessary, a neutral solution requiring 1200 times the theoretical quantity.

3. Direct sunlight accelerates the interaction of hydrogen peroxide and nitrous acid. M. O. F.

Hydrazine Hydrate. By CORNELIUS A. LOBRY DE BRUYN (*Rec. Trav. Chim.*, 1895, **14**, 85—88).—Hydrazine hydrate boils at 47° (22 mm.); its aqueous solution is very stable, and may be boiled for several hours without undergoing change. The hydrate, however, is slowly decomposed when exposed to air free from carbonic anhydride, and, when confined with oxygen over mercury, is oxidised to nitrogen and water. Hydrazine hydrate dissolves caustic soda and potash and various salts, such as potassium iodide, ammonium sulphate, and barium nitrate, but other salts, such as potassium and zinc sulphates, are not dissolved by it. It dissolves sulphur, forming an orange-yellow solution, and hence attacks vulcanised india-rubber, ammonium sulphide appearing to be formed. It also appears to dissolve phosphorus. Sodium decomposes hydrazine hydrate, with liberation of hydrogen and ammonia, and the formation of a crystalline compound, possibly $N_2H_5{\cdot}OH$.

Nearly pure anhydrous *hydrazine* is obtained as a somewhat viscous liquid when a mixture of the hydrate with excess of barium oxide is distilled under diminished pressure. JN. W.

Preparation of Hydrazine Hydrate. By CORNELIUS A. LOBRY DE BRUYN (*Rec. Trav. Chim.*, 1895, **14**, 82—84).—Hydrazine vapour does not attack glass at moderate temperatures, so that silver apparatus is unnecessary if the distillations are made under reduced pressure.

In preparing the hydrate from commercial hydrazine sulphate, the latter is first converted into the bromide by means of barium bromide, and this is then decomposed by the theoretical amount of aqueous potash. After the potassium bromide thus formed has been precipitated with alcohol, the alcoholic solution of the hydrate is distilled under the ordinary pressure until the temperature reaches 108°, but little of the hydrate passing over below this point. Any further precipitate of potassium bromide having been removed, the liquid is fractionated first under atmospheric pressure until the temperature reaches 118°, and then under a pressure of 121—122 mm. The higher fractions are dehydrated with barium oxide, by which agent the hydrate is not affected, and the dry hydrate extracted with alcohol. On refractionating the product under a pressure of 121—125 mm., the fraction boiling at 73° contains 99·7 per cent. of hydrazine hydrate, and is free from silica. The yield, however, is only 22 per cent. of that required by theory.

The author adds in a postscript that the use of barium oxide is unnecessary, equally good results having been obtained by simple fractionation. JN. W.

Reduction of Silica by Carbon. By HENRI MOISSAN (*Compt. rend.*, 1895, **120**, 1393—1394).—Silica volatilises readily in the electric furnace under the influence of the arc from a current of 1000 ampères and 50 volts (Abstr., 1893, ii, 532), and if the action of the arc is stopped before volatilisation is complete, crystals of silicon, like those described by Senarmont, are sometimes found in the lower part of the crucible. When a mixture of rock crystal and carbon is heated in the electric furnace in a carbon tube closed at one end, the open end of the tube becomes full of flocculent volatilised silica, below which are crystals of carbon silicide, whilst still lower in the tube is a ring of crystals of silicon mixed with some carbon silicide. It follows that silica is reduced to silicon by carbon under the influence of the electric arc. C. H. B.

Solid Carbonic Anhydride. By P. VILLARD and R. JARRY (*Compt. rend.*, 1895, **120**, 1413—1416).—Dry carbonic anhydride cooled and solidified in a wide tube melts at −56·7°, and its vapour pressure at this temperature is 5·1 atmos.; it resolidifies at the same temperature, and shows the same vapour pressure. These values approximate very closely to those given by Faraday, and practically the same results were obtained with carbonic acid snow prepared in the usual way.

The crystals of carbonic anhydride have no action on polarised light.

The temperature of solid carbonic anhydride under atmospheric pressure is −79°. In making this determination, precautions were taken to protect the thermometer from radiation from surrounding objects. Regnault found −78·16°, and Pouillet −79°; contrary to the usual statement, the addition of ether does not reduce the temperature, and the minimum of −79° is only obtained when the carbonic anhydride snow is in excess. The heat of dissolution of the solid in the ether is so small that it can only be recognised if the ether has previously been cooled to −79°. Methylic chloride behaves differently, and the solid carbonic anhydride at temperatures below −65° dissolves in it without any evolution of gas, and when the liquid is saturated the temperature is −85°, a result due to the dissolution of the solid. By passing a current of dry air through the mixture its temperature can be reduced to −90°.

Under a pressure of 5 mm., the temperature of the solid anhydride is −125°, and it evaporates very slowly under these conditions. It follows that it should be possible to liquefy oxygen with carbonic anhydride only as the cooling agent and with ordinary laboratory appliances. C. H. B.

Gas showing the Spectrum of Helium, the reputed Cause of D_3, one of the Lines in the Coronal Spectrum. By WILLIAM RAMSAY (*Proc. Roy. Soc.*, 1895, **58**, 65—67), and **Helium, a Gaseous Constituent of Certain Minerals. Part I.** By WILLIAM RAMSAY (*ibid.*, 81—89).—The principal results of these investigations are recorded in the paper by Ramsay, Collie, and Travers (Trans., 1895, 684). H. C.

Density of Helium. By PER T. CLÈVE (*Compt. rend.*, 1895, **120**, 1212).—The gas obtained from cleveite, freed from hydrogen by passing it over red-hot cupric oxide, and from nitrogen by means of magnesium, had the density 2·02 as compared with hydrogen. It contained no argon. C. H. B.

Compound of Argon. By MARCELLIN BERTHELOT (*Compt. rend.*, 1895, **120**, 1316—1319).—When a mixture of argon with carbon bisulphide vapour at about 20° is subjected to the action of the silent electric discharge, there is no production of fluorescence similar to that observed with argon and benzene, but the argon is gradually absorbed, and if the action of the discharge is prolonged, and the carbon bisulphide is renewed from time to time, the absorption may amount to 56 per cent. of the original volume, and probably would become complete. No product is formed which gives reactions analogous to those of mercuric thiocyanate. When the product is heated to the boiling point of mercury and up to a dull red heat, argon is liberated in volume equal to about half that originally absorbed. The argon thus set free gives the characteristic green fluorescence when mixed with benzene vapour and subjected to the action of the silent discharge. C. H. B.

Constitution of Inorganic Compounds. By ALFRED WERNER (*Zeit. anorg. Chem.*, 1895, **9**, 382—417).—A theoretical paper dealing with salts of oxy-acids and molecular (additive) compounds (compare this vol., ii, 225). J. B. T.

Constitution of Metallic Bases. By NICOLAI KURNAKOFF (*J. pr. Chem.*, 1895, [2], **52**, 177—192; compare Abstr., 1894, i, 273).—The author dilates on the necessity for the collation of investigations which have been made into the composition of compounds of the general type, MX_m,nA (where A is a compound of basic character, or a neutral substance such as water, alcohol, &c.), with a view to the abandonment of the old theory of molecular compounds and the formulation of some system to which such metallic bases may be referred. He then proceeds to discuss the subject under the following heads:—(1) The composition and stability of the metal-ammonia compounds, in which X of the above type is a halogen, and A ammonia. Texts for this portion of the subject are culled from the work of Isambert (*Compt. rend.*, 1880, **91**, 768) and of Lachowicz (Abstr., 1889, 569). (2) Changes in the chemical function of both metal and acid in salts induced by the combination of such salts with ammonia or water. (3) The relationship between hydrate and metal-ammonia compounds. A. G. B.

Sodamide. By ROBERT DE FORCRAND (*Compt. rend.*, 1895, **121**, 66—69).—Sodamide was obtained as an amorphous, bulky, white, somewhat volatile compound by passing dry ammonia over sodium fused in iron dishes in a glass tube. When exposed to air, it absorbs water, oxygen, and carbonic anhydride, and is converted into a mixture of sodium nitrite, carbonate, and hydroxide. When mixed with water, it yields ammonia and sodium hydroxide, and the reaction develops so much heat that in presence of air the ammonia ignites and violent explosions may be produced. The heat of dissolution is +31·04 Cal. at 20—22°, and hence—

NH_3 gas + Na sol. = H gas + NH_2 Na sol. develops +20·84 Cal.
NH_3 liq. + Na sol. = H gas + NH_2Na sol. „ +16·44 „

The last value would be reduced by 0·5 to 1·0 Cal. if calculated for solid ammonia. It is about 7 Cal. lower than the corresponding value for acetylene, which, in its turn, is 7 Cal. lower than the mean value for the alcohols.

N gas + H_2 gas + Na sol. = NH_2Na sol. .. develops +33·04 Cal.
NH_3Na sol. = H gas + NH_2Na sol. .... „ +15·64 „

The results obtained by Joannis indicate that solid sodammonium has practically the same heat of formation as solid ammonia, and it seems probable that the reactions NH_3 sol. + Na sol. = H gas + NH_2Na sol. and NH_4 sol. + Na sol. = H gas + NH_3Na sol. likewise develop practically the same quantities of heat. It would follow that NH_3 sol. + H gas = NH_4 sol. would absorb from −15·5 to −16·0 Cal., and it should not be impossible to realise the conditions necessary to the formation of ammonium. C. H. B.

Sodium Hyposulphite. By E. H. Ekker (*Rec. Trav. Chim.*, 1895, **14**, 57—64).—The products of the electrolysis of aqueous solutions of sodium hydrogen sulphite are sodium sulphate, water, and either sodium hydrogen hyposulphite, $NaHS_2O_4$, or a mixture of sodium hyposulphite and free hyposulphurous acid. The yield, however, is too small to render the method of any practical value for the preparation of the hyposulphites, even when the electrolysis is conducted at a low temperature, and in an atmosphere free from oxygen. The maximum, 41 per cent. of that indicated by theory, was obtained after a current of 1·51 ampère had passed for 30 minutes through a saturated solution of the sulphite, but diminished to 6 per cent. after the lapse of another hour. The diminution of the yield with the time was less marked when the solution was previously rendered alkaline with caustic soda. Jn. W.

Recovery of Silver from Solutions. By Wilhelm Venator (*Chem. Zeit.*, **19**, 1895, 77—78).—The acid solution obtained in the parting of gold is neutralised with potassium carbonate, and then precipitated with potassium chloride. The precipitate is well washed by decantation with hot water to remove any lead, and then made into a paste with brine and mercury, about 10 parts of the latter for 1 part of silver. The silver is now reduced by the introduction of scraps of iron, and it then rapidly amalgamates with the mercury. Five hundred grams of silver chloride is generally reduced in 10 hours. The amalgam is cleansed by washing with hot water, and freed from excess of mercury by pressing it in a linen bag, and finally heated in a retort to recover the mercury. As the residue, however, still retains mercury, sometimes as much as 1 per cent., the metal must be purified by fusion with borax.

Potassium nitrate is obtained as a bye-product. L. de K.

Basic Halogen Salts of the Alkali Earths. By Tassilly (*Compt. rend.*, 1895, **120**, 1338—1340).—*Strontium oxybromide*, $SrBr_2,SrO + 9H_2O$, is obtained in beautiful prisms by boiling the oxide with a concentrated solution of the bromide. It is not hygroscopic, but is decomposed by carbonic anhydride and by water. The basic iodide, $2SrI_2,5SrO + 30H_2O$, is obtained in slender needles by dissolving 100 grams of strontium iodide in 100 c.c. of a cold saturated solution of the hydroxide, and boiling until the volume of the liquid is reduced to about one-third. The basic iodide differs considerably from the basic chloride and bromide, and in this respect strontium differs from calcium (this vol., ii, 45).

The barium oxybromide and oxyiodide which Beckmann obtained mixed with the hydroxide are obtained pure in the following ways.

Thirty parts of finely powdered barium hydroxide are added to a hot solution of 300 parts of the bromide in 330 parts of water, and the mixture is heated and allowed to cool; slender, silky needles separate, which have the composition $BaBr_2,BaO + 5H_2O$. The oxyiodide is obtained in colourless, highly refractive prisms of the composition $BaI_2,BaO + 9H_2O$, by dissolving barium iodide in its own weight of a cold saturated solution of the hydroxide, and boiling until the volume of the liquid is reduced to one-third. C. H. B.

Molecular Changes in Chromium Hydroxide. By ALBERT RECOURA (*Compt. rend.*, 1895, **120**, 1335—1338).—The author has previously shown that the precipitate produced by alkali hydroxides in green solutions of chromium salts has the composition $Cr_2O(OH)_4$ (Abstr., 1894, ii, 382), and reacts with 4 mols. HCl only, whereas the normal hydroxide reacts with 6 mols. HCl. He now finds that when chromium hydroxide is dissolved in solutions of alkali hydroxides and reprecipitated by neutralisation with an acid, the power of the precipitate to combine with acids diminishes as the time that it has remained in the alkaline solution increases. After 10 minutes, the precipitate reacts with only 3 mols. HCl, and further addition of acid produces no thermal disturbance. After about three hours, the precipitate reacts with only 1 mol. HCl, in which, however, it dissolves immediately and completely. After a longer time, the combining power diminishes still further, and the precipitate can no longer be completely dissolved in the acid at the ordinary temperature, and finally, after remaining about two months in the alkaline solution, the precipitate will not redissolve in acid at all. It would seem that the alkali exercises a progressive dehydrating effect on the hydroxide $Cr_2(OH)_6 + Aq$, anhydrides being formed by the gradual elimination of OH-groups, and the final product being $Cr_2O_3 + Aq$.
C. H. B.

Molybdenum. By HENRI MOISSAN (*Compt. rend.*, 1895, **120**, 1320—1326).—Molybdenum dioxide, prepared by strongly heating ammonium molybdate, is mixed with one-tenth of its weight of sugar carbon, and heated for about six minutes in a carbon crucible in an arc produced by a current of 800 ampères and 60 volts. With the proportions given, the molybdenum oxide is in excess, and if the action of the arc is stopped before the outer portions of the mixture in contact with the crucible have had time to fuse, molybdenum is obtained quite free from carbon, and containing only from 0·1 to 0·2 per cent. of slag as an impurity (compare Abstr., 1893, ii, 471). If, however, the action of the arc is prolonged until the whole mixture fuses, the crucible is attacked, and, on cooling, a hard, brittle ingot of carboniferous molybdenum is obtained. If the proportion of carbon is 2·5 to 3·0 per cent., the metal is white and very hard, and has all the properties of the molybdenum described by Debray; if the proportion is 4·9 to 5·5 per cent., the metal is grey, and is sufficiently hard to scratch steel and quartz, but is very mobile when fused, and is readily cast in ingots of 8 to 10 kilos. The fused metal dissolves carbon rapidly, and, on cooling, the latter separates as graphite, but if the metal is saturated with carbon, a crystalline carbide is formed.

Molybdenum carbide, Mo_2C, is best obtained by heating a mixture of molybdenum dioxide with one-fifth its weight of carbon for eight or ten minutes in a carbon crucible in an arc formed by a current of 800 ampères and 50 volts. Any excess of carbon remains mixed with the product in the form of graphite. The carbide shows a brilliant, white, crystalline fracture, cleaves readily, and seems to crystallise in elongated prisms; sp. gr. = 8·9.

Pure fused molybdenum is as malleable as iron, files and polishes readily, and will not scratch glass or rock crystal; sp. gr. = 9·01. It can be forged when hot. If free from carbon and silicon, it oxidises but little in air below a red heat, and remains unchanged for several days in water, even when the latter contains carbonic anhydride. At a dull red heat, molybdenum oxidises superficially in the air, and at 600° oxidation becomes marked, and molybdic anhydride slowly volatilises. The anhydride is the product of oxidation in air at high temperatures, but is accompanied by a blue oxide in the oxy-hydrogen flame.

Fused potassium chlorate attacks the metal violently, and the nitrate also oxidises it rapidly, although less violently than the chlorate. If a mixture of molybdenum and lead peroxide is heated, there is intense development of light and heat.

Sulphur has no action on molybdenum at 440°, but hydrogen sulphide at 1200° converts the metal into a sulphide closely resembling molybdenite. Fluorine has no action on masses of the metal at ordinary temperatures, but acts on the coarsely powdered metal with incandescence and formation of a volatile fluoride. Silver, zinc, and lead fluorides are decomposed when heated with molybdenum, but no volatile fluoride is formed. Chlorine attacks molybdenum at a dull red heat without incandescence, and bromine combines with it, though not energetically, at a cherry-red heat. Iodine has no action at the softening point of glass. When the metal is gently heated with phosphorus pentachloride, a volatile chloride is formed, which rapidly acquires a beautiful blue colour when exposed to moist air. This reaction is obtained with most molybdenum compounds, and constitutes a ready test for the metal.

The action of halogen acids on pure molybdenum is similar to their action on the fused metal as described by Berzelius, Debray, and others. Hydrogen fluoride is without effect, except in presence of nitric acid, when the metal is rapidly attacked.

Pure molybdenum does not combine with nitrogen at 1200°, nor with phosphorus at the melting point of glass, but when heated with boron in the electric furnace, it forms a boride, which crystallises in iron-grey, prismatic needles. With silicon, under similar conditions, it forms a crystalline silicide, which does not melt in the oxy-hydrogen flame.

When pure molybdenum is heated in carbon at about 1500°, it undergoes cementation and becomes hard enough to scratch glass, and if heated at 300° and suddenly cooled in water, it becomes brittle and will scratch rock crystal. On the other hand, when carboniferous molybdenum is heated with the dioxide at a temperature much below its melting point, the carbon is removed, a result which seems to be due to the volatility of the oxide.

Molybdenum in masses may be used as a deoxidising agent for overblown Bessemer steel, and has the advantage that the oxide produced is volatile, and any excess of metal that may remain with the iron is malleable like the latter, and will acquire temper under the same conditions. C. H. B.

Ammonium Sodium Hydrogen Tungstates. By L. A. HALLOPEAU (*Compt. rend.*, 1895, **120**, 1343—1345).—When excess of ammonia is added drop by drop to a cold and somewhat dilute solution of sodium paratungstate, an abundant crystalline precipitate is formed, and when this is dissolved in warm water and the solution evaporated in a vacuum, a small quantity of crystals of the salt $16WO_3,3Na_2O,3(NH_4)_2O + 22H_2O$ is obtained; it loses 15 mols. H_2O at 100°. The mother liquor, on further concentration, deposits a considerable quantity of somewhat bulky, colourless, transparent, flattened prisms of the salt $12WO_3,4Na_2O,(NH_4)_2O + 25H_2O$; it loses 19 mols. H_2O at 100°. The first salt is analogous to the salt $8WO_3,3(NH_4)_2O + 8H_2O$, described by Marignac and by Laurent; the second belongs to the series of ammonium sodium paratungstates which have been described by Marignac, Knorre, and Gibbs.

C. H. B.

Paratungstic acid. By L. A. HALLOPEAU (*Compt. rend.*, 1895, **121**, 61—63).—Paratungstic acid is not readily obtained by the action of hydrogen sulphide on the lead salt, nor of hydrochloric acid on the mercurous salt, and although a pure solution of the acid is formed when the silver salt is decomposed by hydrochloric acid, the silver chloride is difficult to separate. The best method is to mix barium paratungstate with a quantity of dilute sulphuric acid not quite sufficient for complete decomposition.

Dilute solutions of paratungstic acid are not decomposed by heat, but prolonged boiling partially converts the paratungstic into metatungstic acid. When the solution is evaporated, even in a vacuum, at the ordinary temperature, some tungstic acid is formed. Alkalis neutralise the solution, and yield paratungstates. Hydrochloric, nitric, and sulphuric acids decompose dilute solutions of paratungstic acid; hydrogen sulphide reduces them with formation of the blue or the green oxide; acetic, phosphoric, and carbonic acids have no action. Organic substances, including filter-paper, reduce the acid with formation of the blue oxide, and a solution mixed with alcohol is similarly reduced when exposed to light.

There would seem to be no doubt that paratungstic acid can exist in the free state in aqueous solution. C. H. B.

Action of Heat on Iridium Potassium Nitrites. By ALEXANDRE JOLY and ÉMILE LEIDIÉ (*Compt. rend.*, 1895, **120**, 1341—1343).—Iridium potassium nitrite is best prepared by adding sodium nitrite to a hot and slightly acid solution of sodium iridiochloride until it is decolorised, boiling to expel nitrous oxides, and adding excess of potassium chloride. The white precipitate is thoroughly washed, and dried at 100—105°. The salt begins to decompose at about 300°, and decomposition is slow and incomplete at 360°, but becomes rapid at 440°. When it is heated in a vacuum at 440°, nitrogen and nitric oxide are liberated, and a greenish-black powder is left. When this is treated with water, potassium nitrite, nitrate, and chloride (present as an impurity) dissolve, and after a time a deep brown, colloïdal product dissolves, and a very heavy, black powder is left. The former consists of hydrated iridium dioxide, quite free from alkali, and can be precipitated by adding ammonium chloride; the latter has very nearly the composition $6IrO_2,K_2O$, and seems to be the potassium salt of *hexiridious* acid, $(IrO)_6O_5(OH)_2$ or $6IrO(OH)_2 - 5H_2O$. This view is supported by the composition of the gas liberated when the double nitrite is heated.

If the double nitrite is heated at incipient redness in a muffle and the product is thoroughly washed, the residue has the composition $12IrO_2,K_2O$, and seems to be the potassium salt of *dodecairidious acid*, $(IrO)_2O_{11}(OH)_2$ or $12IrO(OH)_2 - 11H_2O$. C. H. B.

Mineralogical Chemistry.

Graphitite from Monte Pisano. By Fausto Sestini (*Gazzetta*, 1895, **25**, i, 121—126; compare this vol., ii, 400).—Two minerals from Monte Pisano were found to be samples of graphitite by Luzi's test (Abstr., 1893, ii, 320); the following analytical results were obtained.

	H_2O (hygroscopic).	H_2 and H_2O (combined).	Carbon.	Residue on heating.
I......	5·52	2·65	48·88	42·95
II......	1·95	1·83	18·67	77·55

W. J. P.

Sylvanite from Stassfurt. By W. Schimpff (*Zeit. Kryst. Min.*, 1895, **25**, 92—93).—The sample examined is of interest as containing in negative crystals a relatively large amount of hydrogen sulphide, which gas, on dissolving the salt, escapes under pressure with a crackling noise; hence the name "knistersalz" applied to it. There are also larger cavities containing air and perhaps other gases; and others inclosing mother liquor, to which is attributed the impurities shown in the analysis. The hydrogen sulphide amounts to 3·01 per cent. by volume.

KCl.	NaCl.	$MgCl_2$.	$CaSO_4$.	H_2S.	Insoluble.	Loss on fusion.	Total
99·2390	0·2420	0·0890	0·0730	0·0023	0·1080	0·2847	100·0331

L. J. S.

Copper Iodide (Marshite) from Broken Hill, N.S.W. By C. W. Marsh (*Journ. and Proc. Roy. Soc. N.S.W.*, 1892, **26**, 326—329).—This new mineral occurs as small, translucent, reddish-brown crystals on cerussite; the crystal form is given as tetragonalhemihedral (compare, however, H. A. Miers, *Zeit. Kryst. Min.*, 1894, **24**, 207, who gives it as cubic and tetartohedral); streak orange-yellow. When heated, it gives off iodine, and it is soluble in hot nitric acid with evolution of iodine. The name Marshite is proposed by A. Liversidge. L. J. S.

Cadmiferous Blende from Mies: Rhodochrosite from Asia Minor. By HEINRICH VON FOULLON (*Zeit. Kryst. Min.*, 1895, **24**, 642—643; from *Verh. k. k. geol. Reichsanst*, 1892, 171).—(1) The occurrence of a bright yellow coating on quartz which, on analysis, was found to consist of cadmium sulphide (greenockite) led to the determination of the amount of cadmium in the blende of Mies, Bohemia; analysis gave

Cd.	Cu.	Pb.	Zn.	Fe.	S.	SiO_2.	Total.
0·64	0·18	0·04	62·76	1·79	32·42	1·60	99·43

(2) Rhodocrosite, occurring as large rhombohedra with galena, blende, fahlerz, &c., at the Ary Maghara mine, near Balia-Maaden, gave on analysis

MnO.	MgO.	FeO.	CaO.
19·67	4·62	0·74	32·05

L. J. S.

Thallium and Molybdenum in Hæmatite. By LARS J. IGELSTRÖM (*Zeit. Kryst. Min.*, 1895, **25**, 94).—In a specimen of platy hæmatite from the Sjö mine, Örebro, Sweden, molybdenum was found, which "as Mo_2O_3 (up to 9 per cent.) possibly occurs as isomorphously mixed with Fe_2O_3." The hydrogen sulphide precipitate obtained from a massive specimen contained molybdenum, calcium and thallium as shown by the spectroscope; another sample contained molybdenum but no thallium. L. J. S.

Baddeleyite (Native Zirconia). By LAZARUS FLETCHER (*Min. Mag.*, 1893, **10**, 148—160).—The characters of this new mineral were determined on a single, rough crystal from Rakwana, Ceylon, where it was found with geikielite. The crystal is opaque, and of an iron-black colour, and submetallic to subresinous in lustre; it is monosymmetric, and twinned on the ortho-pinacoid. Thin splinters are transparent and pleochroic; plane of the optic axes the plane of symmetry. Before the blowpipe, it is incandescent and infusible; insoluble in acids. The chemical examination on small splinters showed the mineral to consist of zirconia. Sp. gr. 6·025. The same mineral from Brazil has been described by E. Hussak under the name "brazilite" (*Jahrb. f. Min.*, 1892, ii, 141), its true chemical nature not, however, being published until later (compare Abstr., 1893, ii, 286). Recently the same author has re-described the mineral under the name baddeleyite (*Tsch. Min. Mitth.*, 1895, **14**, 395), the only discrepancy between this description and that of the Ceylon crystal being in the density and cleavage. L. J. S.

Celestite from Giershagen, Westphalia. By ANDREAS ARZRUNI and KONSTANTIN THADDÉEFF (*Zeit. Kryst. Min.*, 1895, **25**, 38—72).—The celestite from this locality is of interest as being chemically pure strontium sulphate, neither calcium nor barium being detected spectroscopically. The crystals are prismatic in the direction of the *c* axis, and are mostly colourless; $a:b:c = 0{\cdot}77962:1:1{\cdot}28533$. Sp. gr. 3·9665. The mean of four determinations gave $SO_3 = 43{\cdot}71$ per cent., there being only a slight variation; the results for the amount of strontium, however, varied with the method of analysis, and it is shown that greater accuracy is obtained when it is precipitated as carbonate than as sulphate; but that the best results are obtained when the mineral is decomposed with a saturated solution of ammonium carbonate. The variations in the crystal angles of celestite are discussed in detail, and it is pointed out that this variation, of 1° or more, which is usually considered (but not at all proved) to be due to the presence of calcium or barium, occurs not only on crystals from different localities but even on the same crystal. The cause of this variation is explained by the crystals being built up of smaller elements not quite in parallel position, the influence of any isomorphously contained calcium, &c., being quite subordinate. The variations of the optic axial angle and of the sp. gr. are more likely to be due to the presence of calcium, &c., although no connection has been traced; the not quite parallel growth will, however, have some influence on the optic axial angle. From the published measurements, the following constants for "normal" celestite are deduced. $a:b:c = 0{\cdot}78093:1:1{\cdot}28324$. $2V_{aNa} = 50° 34', 2E = 87° 45'$. Sp. gr. 3·9665.

The existence of barytocelestite as a true isomorphous mixture is doubted. L. J. S.

Kamarezite. By KARL H. E. G. BUSZ (*Jahrb. f. Min.*, 1895, i, 115—119).—This new mineral from Kamareza, Laurium, Greece, is grass-green and shows a crystalline structure, with small, needle-shaped, apparently orthorhombic crystals in cavities. The mean of four partial analyses is

CuO.	FeO.	SO_3.	H_2O. [diff.]
51·50	0·69	17·52	[30·29]

This agrees with the formula $3CuO,SO_3,8H_2O$. About half the water is given off between 220° and a low red heat; at a higher temperature, the remainder of the water and some sulphuric anhydride are expelled, the residue being black, and consisting of sulphide and oxide of copper. Sp. gr. 3·98. L. J. S.

A Basic Ferric Sulphate. By ARTHUR H. CHURCH (*Min. Mag.*, 1895, **11**, 13—14).—An orange-coloured ochreous substance from Parys Mount, Anglesey, which under the microscope was seen to be crystalline, gave on analysis

SO_3.	Fe_2O_3.	SiO_2.	H_2O.	Al_2O_3,CaO, &c. [Diff.]
13·44	57·85	2·14	26·36	[0·21]

Half the water was lost at 100°. This agrees with the formula

$2Fe_2O_3,SO_3,8H_2O$. The yellow precipitate produced on exposing ferrous sulphate solution to the air corresponds with this.

L. J. S.

Augelite. By GEORGE T. PRIOR and LEONARD J. SPENCER (*Min. Mag.*, 1895, **11**, 16—23).—This rare mineral, before only known in the massive state, was found as colourless, transparent, mono-symmetric crystals with bournonite from Machacamarca, Bolivia. Analysis gave

P_2O_5.	Al_2O_3.	CaO.	H_2O.	Total.
34·60	51·40	0·11	13·77	99·88

this agreeing with the formula $2Al_2O_3,P_2O_5,3H_2O$. Sp. gr. 2·696.

L. J. S.

Analyses of some Arsenates and Phosphates. By ARTHUR H. CHURCH (*Min. Mag.*, 1895, **11**, 1—12).—(1.) Euchroite, a specimen from Libethen, Hungary, of sp. gr., 3·42, gave, on analysis,

H_2O in a vacuum.	H_2O at 100°.	H_2O at low redness.	CuO.	As_2O_5.	P_2O_5.	Undetermined.
1·22	1·90	16·16	47·26	30·90	1·48	1·08

This agrees with the usually accepted formula $4CuO,As_2O_5,7H_2O$. The water lost in a vacuum and at 100° corresponds with $1H_2O$.

(2.) Liroconite. A Cornish specimen of sp. gr. 2·97 gave on partial analysis

H_2O. in a vacuum.	H_2O at 100°.	CuO.	As_2O_5.	P_2O_5.
6·40	9·85	36·73	23·85	1·02

This corresponds with a loss of $3H_2O$ in a vacuum and of $5H_2O$ at 100°, and with the formula $4CuO,Al_2O_3,As_2O_5,13H_2O$.

(3.) Clinoclase. Analysis gave

H_2O. [Diff.]	CuO.	As_2O_5.
[7·20]	62·72	30·08

Formula $3CuO,As_2O_5,3(CuO,H_2O)$. Only 0·08 per cent. of water was lost in a vacuum and at 100°. A trace of phosphoric acid was present.

(4.) Tyrolite. In a previous paper (this Journal, 1873, **26**, 108) the author considered the calcium carbonate in this mineral to be present as an essential ingredient and not as an accidental impurity, and the following experiment is taken to support this view. A current of carbonic anhydride, passed through water in which the powder was suspended, acted on the mineral as a whole, the solution containing the same relative amounts of calcium and copper as the original mineral; further on allowing the solution to remain for a time a substance separated on the surface having all the appearances of the original mineral. The absence of carbonic anhydride in the Utah mineral analysed by Hillebrand is explained by the mineral not being tyrolite, or to elimination by substitution. In the analyses given in the paper quoted the 7 or 8 per cent. of water lost in a vacuum or at 100° is now considered as essential, and, as it represents half the total water, these analyses are now interpreted as

$$(Cu_3As_2O_8,2H_2O),CaCO_3,2Cu(OH)_2,4H_2O.$$

(5.) Pharmacolite. In a vacuum at 16°, there was a loss corresponding with $3H_2O$ in the formula $2CaO,H_2O,As_2O_5,5Aq$; between 100° and 200° there was a further loss corresponding with $1H_2O$.

(6.) Cacoxenite. Analysis of a Bohemian specimen gave

H_2O in a vacuum.	H_2O on ignition.	Fe_2O_3.	P_2O_5.	F.
18·69	13·11	48·57	19·76	trace

From this, the formula $9Fe_2O_3,4P_2O_5,51H_2O$ is deduced, or

$$4(Fe_2O_3,P_2O_5,4H_2O),5(Fe_2O_3,H_2O),30H_2O,$$

or $(Fe_2O_3,P_2O_5,3H_2O),(Fe_2O_3,2H_2O),7H_2O$.

The $30H_2O$ in the second formula corresponds with the water lost in a vacuum over sulphuric acid.

(7.) Kühnite. Analysis of a specimen from Långban gave

CaO.	MgO.	MnO.	As_2O_5.	Total.
21·61	13·00	3·28	56·25	94·14

The main part of the deficiency is due to an intimate admixture of about 7 per cent. of calcite with the true kühnite, $(Ca,Mg,Mn)_3As_2O_8$. At a low redness there was a loss of only 0·26 per cent.

L. J. S.

Lewisite and Zirkelite, two new Brazilian Minerals. By Eugen Hussak and George T. Prior (*Min. Mag.*, 1895, **11**, 80—88).—*Lewisite* occurs at the cinnabar mine of Tripuhy, near Ouro Preto, as small, translucent, regular octahedra of a honey-yellow to colophony-brown colour, and vitreous to resinous lustre. It has a fairly perfect octahedral cleavage; sp. gr. 4·950. Insoluble in acids. Analysis gave

Sb_2O_5.	TiO_2.	CaO.	FeO.	MnO.	Na_2O.	Total.
67·52	11·35	15·93	4·55	0·38	0·99	100·72

This agrees with the formula, $5RO,3Sb_2O_5,2TiO_2$, or

$$3(RO,Sb_2O_5),2(RO,TiO_2).$$

The mineral is thus related on one side to the calcium titanate perofskite, and on the other to the calcium antimonates, atopite and romeite; or it is related to the pyrochlore group in having antimonic acid in place of niobic acid.

A new titanoantimonate of iron, apparently orthorhombic, containing about 40 per cent. of FeO and about 17 per cent. of TiO_2, and with sp. gr. 4·529, is mentioned as being found at the same locality. Several of the associated minerals are described crystallographically.

Zirkelite, this new calcium zirconate and titanate occurs at the iron mine of Jacupiranga, S. Paulo, as small, opaque, regular octahedra, black and of a resinous lustre; sp. gr. 4·706. Analysis gave

ZrO_2.	TiO_2.	FeO.	CaO.	MgO.	Loss.	Total.
48·90	30·89	6·64	11·61	0·49	1·02	99·55

The relative amounts of ZrO_2 and TiO_2 are somewhat uncertain, owing to the difficulty of separation. L. J. S.

Pyrochlore from Alnö, Sweden. By P. J. Holmquist (*Jahrb. f. Min.*, 1895, ii, Ref. 15—16; from *Geol. För. Förh.*, 1893, **15**, 588—606).—Numerous octahedra of this mineral occur with zircon, perofskite, titaniferous magnetite and other minerals in a metamorphic limestone at the above locality; the larger crystals are light-brown to black, and have a sp. gr. of 4·3528—4·3533 (Analysis I), whilst the smaller crystals are transparent, and of a light, reddish-yellow colour, having a sp. gr. of 4·4460 (II). In sections, the mineral is fresh and isotropic, and shows a zonal structure.

	Nb_2O_5.	TiO_2.	ZrO_2.	FeO.	Ce_2O_3.	ThO_2.	CaO.	Na_2O.	K_2O.
I.	58·83	3·70	2·90	4·20	3·99	0·41	16·75	3·44	1·41
II.	63·64	—	4·90	1·14	4·36	—	18·13	4·99	0·60

	H_2O.	F.	Total.	Total (less O for F_2).
I.	0·78	4·34	100·75	98·92
II.	0·47	4·31	102·54	100·73

These analyses may be represented by the general formula $m(2RO,Nb_2O_5) + RO,(Zr,Ti)O_2$. In II there is enough fluorine to replace all the oxygen in the metazirconate, and $m = 6$, so that the formula becomes $6(2RO,Nb_2O_5) + RZrF_6$, or

$$5(2CaO,Nb_2O_5),(2Na_2O,Nb_2O_5),Na_2ZrF_6.$$

For I, if $Ti : Zr = 2 : 1$, the formula may be written

$$3(7CaO,Na_2O,4Nb_2O_5),Na_2O,TiO_2,Na_2TiF_6,Na_2ZrF_6.$$

As the fluorine and alkalis of pyrochlore and other minerals exist in the atomic ratio of 1 : 1, it is suggested by the author that in the action of alkaline fluorides as mineralising agents, the alkalis as well as the fluorine go to form the resulting minerals. L. J. S.

Geikielite. By Allan B. Dick (*Min. Mag.*, 1893, **10**, 145—147).—This new mineral was found as pebbles in the gem mines of Rakwana, Ceylon. It is bluish- or brownish-black, and in thin fragments, by transmittent light, purplish-red; there is one perfect cleavage with an imperfect one nearly at right angles to the former; the lustre on the cleavage face is metallic-adamantine. Optically uniaxial. It is infusible, and is decomposed by hot, concentrated hydrochloric acid, and also by cold hydrofluoric acid, the titanium oxide separating out. Analysis gave

TiO_2.	MgO.	FeO.	Total.
67·74	28·73	3·81	100·48

This mineral $MgTiO_3$, corresponds to the calcium titanate, perofskite. Sp. gr., 3·98—4. Some of the pebbles inclose much rutile.

L. J. S.

Nephrite from Kuen-Lun. By ANDREAS ARZRUNI (*Zeit. Kryst. Min.*, 1895, **24**, 632; from *Zeit. f. Ethnologie, Berlin*, 1892, 19).—A specimen of marked schistose and fibrous texture, from the old locality Shahidulla-Chodja, showed under the microscope secondary serpentine and a chloritic mineral, also isolated prisms of pyroxene partly altered to amphibole, and large amphibole crystals, around which the nephrite fibres were arranged perpendicularly. Analysis gave results in agreement with the usual metasilicate formula.

SiO_2.	Al_2O_3.	FeO.	CaO.	MgO.	H_2O.	Total.
57·81	1·58	2·60	13·71	22·51	1·75	99·96

To the east of the old localities, nephrite has recently been found, namely between Kukunor and the Nan-Schan mountains, in the Chinese province Kansu.

L. J. S.

Analyses of Heulandite and Smithsonite. By L. G. EAKINS and HENRY N. STOKES (*Zeit. Kryst. Min.*, 1895, **24**, 624; from *Bull. U.S. Geol. Survey*, 1892, No. **90**, 62).—Heulandite from Anthracite Creek, Gunnison Co., Colorado, gave

SiO_2.	Al_2O_3.	CaO.	K_2O.	Na_2O.	H_2O.	Total.	Sp. gr.
57·38	17·18	8·07	0·40	0·82	16·27	100·12	2·24

Smithsonite, of a bright golden-yellow colour, from Marion Co., Arkansas, gave

CO_2.	ZnO.	CdO.	CaO.	FeO.	CdS.	SiO_2.	Total.
34·68	64·12	0·63	0·38	0·14	0·25	0·06	100·26

L. J. S.

Analyses of Natrolite, Tourmaline, Spessartite, Bismuthinite, and Felspar. By WILLIAM H. MELVILLE (*Zeit. Kryst. Min.*, 1895, **24**, 622—623; from *Bull. U.S. Geol. Survey*, 1892, **90**, 38 and 65).—(1) Natrolite from Magnet Cove, Arkansas, gave, on analysis,

SiO_2.	Al_2O_3.	FeO.	CaO.	MgO.	Na_2O.	H_2O.	Total.
47·56	26·82	0·20	0·13	0·09	15·40	9·63	99·83

Of the water 0·07 per cent. was given off at 100°, 0·19 at 250°, 3·42, at 300—350°, and 5·95 on ignition. Sp. gr. 2·261.

(2) Tourmaline, occurring at Colfax, Nevada Co., California, as transparent, almost colourless needles, gave

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	F.	Loss at 100°.
36·40	33·64	3·13	1·51	10·01	0·12	2·49	0·74	0·02

Loss on ignition.	B_2O_3.	Total.	Total (less O for F).	Sp. gr.
3·51	6·52	98·07	97·76	3·065

(3) Spessartite, from Llano Co., Texas, gave

SiO_2.	Al_2O_3.	Fe_2O_3.	MnO.	CaO.	MgO.	Alkalis.	Loss.	Total.
35·93	18·08	4·60	31·77	8·48	0·69	0·17	0·39	100·38

To bring this into agreement with the garnet formula, some of the manganese must exist as sesquioxide.

(4) Bismuthinite, from Rosario District, Sinaloa, Mexico, gave

Bi.	Pb.	Cu.	Fe.	S.	SiO_2.	Total.
72·90	6·03	1·67	0·35	18·11	0·63	99·69

This analysis indicates admixture of galena, copper pyrites and quartz with the bismuth sulphide. The mineral occurs, as a large deposit, in large, brilliant blades, and is used for extraction of bismuth, as well as of gold and silver. Sp. gr. 6·624.

(5) Felspar, from the elæolite-syenite of Litchfield, Maine, gave

	SiO_2.	Al_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	65·14	18·19	0·25	0·33	0·16	14·14	1·68	0·17	100·06
II.	68·28	19·62	0·23	0·31	0·09	0·39	10·81	0·09	99·82

Sp. gr. of I, 2·56; of II, 2·622. L. J. S.

Composition of Idocrase (Vesuvian). By Mats Weibull (*Zeit. Kryst. Min.*, 1895, **25**, 1—37).—The mode of occurrence and the crystallography of brown idocrase from Tennberget, Dalarne, Sweden, are minutely described. The mean of six partial analyses is given under I; sp. gr. 3·325; $a : c = 1 : 0{\cdot}53539$; optically uniaxial and negative. The orthosilicate formula, $12CaO,3Al_2O_3,10SiO_2,(H_2O,F_2)$, is deduced, the alkalis being reckoned as $R''O$. The loss on ignition is slightly greater than $H_2O + F$, and experiments were made which tend to show that the white fumes evolved on ignition consist of aluminium fluoride.

	SiO_2.	Al_2O_3.	B_2O_3.	Fe_2O_3.	FeO.	CaO.	MnO.	MgO.
I.	37·83	16·92	—	1·78	3·36	35·01	0·06	2·20
II.	37·97	16·25	0·10	3·87	0·55	35·34	—	2·46

	K_2O.	Na_2O.	H_2O.	F.	Total.	Total (O less F).
I.	0·23	1·15	0·77	1·72	101·03	100·30
II.	0·13	0·28	$\overbrace{1{\cdot}08 \quad 1{\cdot}60}$	—	99·63	—

Previous analyses, in which the water and fluorine were directly determined, are reduced to the above formula. A structural formula showing the relation to garnet is given.

Some idocrases free from fluorine have also been examined; crystals from Cziklowa, Hungary, with $a : c = 1 : 0{\cdot}5340$, and showing optical anomalies, gave the analysis II. This analysis agrees with the above formula when the water is considered as partly an acid and partly a basic constituent; this is supported by the fact that part of the water

(1·08 per cent.) goes off at a red heat, whilst the remainder is only expelled at a much higher temperature; the former part being considered to be the basic, and the latter the acid water. Previous analyses of idocrases free from fluorine are discussed, and in the formula of some, the radicles Al(OH),Mg(OH) or Ca(OH) are supposed to exist with the bases. It is noticed, that although the amounts of the other bases vary, the calcium is pretty constant (35 per cent.), this represents five-sixths R″, and in the general formula $Ca_5R''Al_2[R'''(OH,F)]Si_5O_{20}$. No connection can be traced between the variation of the ratio $a : c$ and the chemical composition.

L. J. S.

Zinnwaldite from Mourne Mountains, Co. Down. By William J. Sollas (*Proc. Roy. Irish Acad.*, 1890, [3], **1**, 379—380).—This lithia mica occurs as well-developed crystals with topaz, &c., in the druses of the Mourne Mountain granite. The crystals show a zonal structure, the centre being usually green, this graduating to colourless at the periphery; this difference in colour is associated with a difference in specific gravity, of 3·2 to 2·8 (the less dense portion being lighter in colour, and containing more lithium), and an increase in the optic axial angle from 44° 4′ to 52° 6′. These variations indicate a passage from a mica richer in iron and magnesia at the centre to one richer in alumina and alkalis at the periphery; this difference in composition is probably due to the action of the magma on the already formed crystals. Zinnwaldite, which is distinguished from lepidolite by the position of the optic axial plane, has not been before recorded from Ireland. L. J. S.

The so-called Schneebergite. By Arthur S. Eakle and Wilhelm Muthmann (*Zeit. Kryst. Min.*, 1895, **24**, 583—586).—Brezina gave this name to a mineral occurring as small, honey-yellow, regular octahedra at Schneeberg, Tyrol, stating that it consists essentially of antimony, calcium and a little iron (compare Abstr., 1882, 150); it has, therefore, been considered to be near, or to be identical with, atopite. From the analysis made by the authors, it is, however, seen to be really a calcium iron garnet, neither antimony, bismuth nor copper having been detected.

SiO_2.	Fe_2O_3.	CaO.	Total.	Sp. gr.
35·45	32·22	32·58	100·25	3·848

The material is rendered impure by inclosing, or being otherwise associated with, magnetite, blende, copper pyrites, quartz, calcite, and breunnerite; the mineral having been derived from the last two. The occurrence of a topazolite without any alumina and as octahedra is of interest. L. J. S.

Delessite from Cantyre. By M. Forster Heddle and J. Stuart Thomson (*Min. Mag.*, 1895, **11**, 28—29).—A dark green delessite occurring as veins in the dolerite of Knockscalbert quarry, gave, on analysis

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	H_2O.	Total.
34·69	5·48	10·82	18·71	2·49	12·21	15·19	99·59

7·29 per cent. of water was given off at 100°. Sp. gr. 2·608. Delessite is of much rarer occurrence in Scotland than saponite.

L. J. S.

Crossite, a New Soda Amphibole. By CHARLES PALACHE (*Bull. Geol. Dep. Univ. Calif.*, 1894, **1**, 181—191).—This blue amphibole occurs as small prisms embedded in the white albite of the crystalline schists near Berkeley, California. The optical characters resemble those of riebeckite, the extinction angle of 13° being, however, greater; the pleochroism is very strong, varying from dark blue to yellowish. Sp. gr. 3·16. Analysis gave

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	Na_2O.	K_2O.	Total.
55·02	4·75	10·91	9·45	trace	9·30	2·38	7·62	0·27	99·70

The composition is thus between that of riebeckite and that of glaucophane. The optical characters closely resemble those of a mineral from Colorado, described by Whitman Cross (*Amer. J. Sci.*, 1890, [3], **39**, 359).

L. J. S.

Urbanite, a New Pyroxene. By S. A. HJALMAR SJÖGREN (*Geol. För. Förh.*, 1892, **14**, 251—253; and *Bull. Geol. Inst. Upsala*, 1894, **2**, 77—87, 106—108).—This mineral, which occurs as veins in hæmatite at the Långban mines, Sweden, was first examined by Breithaupt in 1865, it being then considered to be identical with the schefferite from the same locality. In drusy cavities, brilliant, brownish-black or black, monosymmetric crystals have been found; these have an octahedral habit, and their morphological and optical constants approach those of acmite rather than those of schefferite. Sp. gr. 3·52. The analysis I corresponds to the metasilicate formula $(Ca,Mg)O,SiO_2 + Na_2O,Fe_2O_3,4SiO_2$, the first part representing diopside, and the second part acmite. The high percentage of ferric oxide and of alkalis further distinguishes the mineral from schefferite.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.
I. Långban,	51·61	—	0·74	27·24	0·54	1·73	4·90	2·75
II. Glakärn,	49·21	0·06	1·27	25·35	0·50	6·71	5·68	1·39

	K_2O.	Na_2O.	H_2O.	F.	Loss on ignition (probably water).	Total.
I.	0·36	10·59	—	—	0·90	101·36
II.	0·40	8·95	1·05	0·20	—	100·69

Igelström's "*lindesite*" from the Glakärn mine, Örebro (this vol., ii, 76), has been re-analysed by Mauzelius, giving the results under II, from which a similar formula to the above is deduced, namely, $(Ca,Mn)O,SiO_2 + Na_2O,Fe_2O_3,4SiO_2$, this representing, as regards composition, a rhodonite with an acmite molecule. The mineral occurs at this locality as embedded grains in manganese ores, and agrees in its physical characters with the urbanite of Långban. Sp. gr. 3·53.

L. J. S.

Analyses of Nickel-silicate Ores. By HEINRICH VON FOULLON (*Zeit. Kryst. Min.*, 1895, **24**, 643—644; from *Jahrb. k. k. geol. Reichsanst.*, 1892, **42**, 223—310).—Nickel silicates of very variable composition occur in veins in decomposed olivine rocks, the origin of the nickel being traced to the olivine, which mineral, in the harzburgite of Riddle, Oregon, contains 0·32 per cent. NiO, while the bronzite of the same rock contains scarcely a trace. The nickel ores of Revda in the Urals (I), Riddle (II), and New Caledonia (III) consist of light-green, optically uniaxial flakes, apparently hexagonal in outline; they seem to be talc-like minerals, with Ni in place of Mg, which approach garnierite. The ores from near Frankenstein, Silesia, were separated by washing into (IV) a yellowish-green material consisting of optically biaxial flakes, and (V) an apple-green material consisting of optically uniaxial flakes; both these were decomposed by hot hydrochloric acid, and, on heating, became tombac-brown in colour, and showed an increase in the optic axial angle; they appear to be related to the chlorites. VI and VII are also from near Frankenstein.

	I.	II.	III.	IV.	V.	VI.	VII.
SiO_2	54·15	48·82	34·60	38·42	40·05	44·74	51·88
Al_2O_3	0·23	—	0·69	9·76	4·52	0·00	3·94
Fe_2O_3	0·27	0·06	0·52	5·68	2·20	1·29	2·33
FeO	—	—	—	0·59	0·53	—	1·19
NiO	27·61	19·04	46·87	8·88	21·17	27·02	2·97
MgO	6·82	18·49	5·35	20·22	18·23	15·38	22·76
CaO	—	—	—	—	trace	—	10·57
H_2O at 100°	3·65	9·26	2·52	16·68	14·06	10·29	1·16
H_2O on ignition	4·09	3·03	7·68				2·69
Total	96·82	98·70	98·23	100·23	100·76	98·72	99·49

L. J. S.

Garnet Hornfels from Co. Dublin. By WILLIAM J. SOLLAS (*Sci. Proc. Roy. Dublin Soc.*, 1891, N.S., **7**, 48—54).—This rock occurs in schists near the granite at Carrickmines; the bulk analysis is given under I, there being also traces of TiO_2 and K_2O; sp. gr. 2·925. It contains the minerals ilmenite, garnet (II, sp. gr. 4·16), green manganese-mica (III, sp. gr. 2·795—3·01), and muscovite in a mosaic of quartz and felspar.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	Na_2O.	H_2O.
I.	48·61	21·61	10·92	2·26	12·09	0·51	0·05	3·02	2·10
II.	37·63	16·43	7·85	14·59	18·55	3·49	2·10	—	—
III.	35·62	16·21	22·01	—	16·55	—	—	2·87	6·52

The garnet is represented by

$$4[3SiO_2,Al_2O_3,3(Mn,Fe)O] + 3SiO_2,Fe_2O_3,3(Mg,Ca)O;$$

the iron of the mica exists mostly in the ferrous state. The rock is supposed to have originated by the contact-metamorphism of a manganese-bearing slate.

L. J. S.

The Leinster Granites. By WILLIAM J. SOLLAS (*Jahrb. f. Min.*, 1895, ii, 80—85; from *Trans. Roy. Irish Acad.*, 1891, **29**, 427—514).—As is well known, the granite of this area is a two-mica granite; only at two points does a granitite (that is, biotite-granite) occur. The rocks are divided into two types—soda granites, and potash granites. The soda granite of Aughrim gave analysis I, and the proportions of the constituents were determined as, sphene and epidote, 0·546; primary mica, 7·328; zonal felspar, 51·143; microcline, 9·193; quartz, 31·790 per cent.; sp. gr. 2·68. A porphyritic dyke from this granite gave the results under II. The minerals of the granite were separated by means of the author's graduated column of a heavy solution (*Nature*, 1891, **43**, 404; 1893, **49**, 211), and each described in detail. The dark mica, haughtonite, from Aughrim, gave the results under III, and for it the formula $Si_{12}R'''_7R''_9R'_{13}O_{48}$ is derived. The soda lime felspars are represented by all the members of the series, and the amounts of the alkalis in several of different sp. gr. are given; IV gives the analysis of albite, of sp. gr. 2·628, from Three Rock Mountain. Microcline from the last locality, of sp. gr. 2·57, gave 12·15 per cent. of K_2O and 3·69 of Na_2O.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.
I.	70·69	15·20	3·76	—	3·31	0·45	2·31	4·69	0·56
II.	71·78	15·86	4·19	—	3·16	0·50	1·13	4·10	1·17
III.	33·95	17·13	2·44	21·18	2·03	6·60	7·12	2·83	3·70
IV.	67·17	20·50	0·22	—	1·61	trace	10·16	0·65	0·31

	TiO_2.	P_2O_5.	F.
III. (*contd.*)	3·81	0·68	trace

The author develops Tschermak's hypothesis of the composition of the micas, giving as a nucleus to his structural formula a "silica ring" consisting of six silicon and six oxygen atoms alternating; the two remaining valencies of each silicon being joined to such groups as $\begin{matrix}\cdot O\\ \cdot O\end{matrix}{>}R'''\cdot O\cdot R'$, $\begin{matrix}\cdot O\cdot R''\\ \cdot O\cdot R''\end{matrix}{>}O$, $\begin{matrix}\cdot O\cdot R''\cdot O\cdot R'\\ \cdot O\cdot R''\cdot O\cdot R'\end{matrix}$, &c. Thus a biotite having, according to Tschermak, the composition $2(H_2KAl_3Si_3O_{12}) + Mg_6Si_3O_{12}$, is represented by a silica ring with four of the first of the above groups and two of the second. L. J. S.

Water of the Sea of Marmora. By KONRAD NATTERER (*Monatsh.*, 1895, **16**, 405—581; compare Abstr., 1893, ii, 216: 1894, ii, 102).—The author gives a detailed account of the investigations made during the expedition of the ship "Taurus" in the sea of Marmora in May, 1894. The results obtained in the exact determination of the physical and chemical properties and condition of the water at 44 different stations and at various depths are fully set out, and are such as, on the whole, might be expected from the position of a deep sea connected at one end with the Ægean Sea by the Dardanelles, and at the other with the Black Sea by the relatively shallow Bosphorus. A full description of the analytical methods and of the apparatus employed is given, and this is supplemented by numerous tables, charts, and diagrams. G. T. M.

Physiological Chemistry.

Is Argon contained in Vegetable or Animal Substances? By GEORGE W. MACDONALD and ALEXANDER M. KELLAS (*Proc. Roy. Soc.*, 1895, **57**, 490—492).—The authors have examined the gases obtained by nitrogen estimations, performed by Dumas' method, in order to determine the absence or presence of argon. They conclude that there is no appreciable quantity of argon in either vegetable or animal substances, or at least that the argon is not liberated with the nitrogen in Dumas' method. E. C. R.

Pepsin. By AUGUSTIN WRÓBLEWSKI (*Zeit. physiol. Chem.*, 1895, **21**, 1—18).—The pepsins obtained from the stomachs of children, dogs, and pigs behave differently in the presence of different acids, and in this respect, moreover, they are different from one another. Twelve acids in all were used in the experiments, and their beneficial effect on peptic activity is not proportional to their strength. Using equivalent quantities of acid, oxalic was found to be that most favourable to digestion, and hydrochloric acid comes next. Certain alkaloïds also are not without influence; for instance, caffeïne is the one which acts most favourably, and veratrine that which acts most injuriously on gastric digestion. The caseïn of cow's milk is recommended as a good substance for testing the activity of pepsin mixtures.

W. D. H.

Kühn's Method of Artificial Digestion of Nitrogenous Food Constituents by Pepsin Solution. By A. KÖHLER, F. BARNSTEIN, and W. ZIELSTORFF (*Landw. Versuchs-Stat.*, 1895, **46**, 193—200).—Kühn's artificial digestion method (Abstr., 1894, ii, 390) may be simplified by adding the hydrochloric acid (11 per cent.) in two portions, 15 c.c. at the commencement of the experiment, and 25 c.c. after 24 hours, instead of in smaller quantities at short intervals. In most cases it is unnecessary to extract the fat before submitting the food to the action of the pepsin solution. N. H. J. M.

Influence of Fat and of Starch on Metabolism. By A. WICKE and HUGO WEISKE (*Zeit. physiol. Chem.*, 1895, **21**, 42—67).—The point specially investigated is the influence of non-nitrogenous food on nitrogenous metabolism. The experiments were made on two sheep, the food, fæces, and urine being analysed and compared in the usual way. The main results were as follows:—Administration of starch lessens the digestion and absorption of fat, and especially of proteïds and cellulose. Administration of fat does not have this effect. In both cases, the amount of fæces (dried) was increased; after starch, the water in the fæces is increased; after fat, it is not.

W. D. H.

Influence of the Thyroid Gland on Metabolism. By ERNST ROOS (*Zeit. physiol. Chem.*, 1895, **21**, 19—41).—The history of the subject, so far as it relates to the use of thyroid extract in the relief of myxœdema, is first given. Observations on men showed a marked increase of excretion of phosphoric acid while under treatment; the greater number of the experiments related, however, were made on dogs; the thyroid had been previously removed, and then the gland was administered as food to them. The urine and fæces were analysed. Some control experiments were made on healthy dogs. In the latter there is increase of nitrogen (more than can be explained by the nitrogen in the gland given), of sodium chloride, and phosphoric acid excreted. The rise in sodium chloride does not last so long as the others.

In dogs without a thyroid, the increased excretion of nitrogen and chlorine is more marked than in healthy animals, whilst the rise in the excretion of phosphoric acid is not so marked. There is also a diuretic action.

Some attempts to separate and identify the active substance in the thyroid were made. This part of the research is incomplete. So far as it goes, it shows that the substance is pretty stable; it is not an enzyme, and is probably proteïd-like in nature. W. D. H.

Acid Fodder and its Effects on the Organism. By HUGO WEISKE (*Zeit. physiol. Chem.*, 1895, **20**, 595—605).—The experiments were made on rabbits, and the effects to which particular attention is drawn are those in the skeleton. Oats have, in contrast with hay, mineral constituents with an acid reaction. Animals fed on oats and other grains alone, suffer and die. At first the weight increases, but soon an acid reaction of the urine sets in, the body loses weight, and marked effects on bones and teeth are evident. In young animals, the poverty of oats in calcium also produces an effect. These facts are illustrated by experiments on rabbits of the same litter and different diets. Some were fed normally, others on oats *plus* either calcium sulphate or phosphate. The animals, 47 days later, were killed. The following table gives the main analytical results:—

Diet.	Oats + $CaSO_4$.	Oats + $Ca_3(PO_4)_2$.	Normal.
Bone, dried and fat free	53·032 gram	56·862 gram	59·417 gram
Organic constituents...	19·706 ,,	20·908 ,,	22·916 ,,
Mineral ,, ...	33·326 ,,	35·954 ,,	36·501 ,,
CaO	17·144 ,,	18·406 ,,	18·711 ,,
MgO	0·372 ,,	0·409 ,,	0·463 ,,
CO_2	1·541 ,,	1·746 ,,	1·785 ,,
P_2O_5	13·242 ,,	14·108 ,,	14·462 ,,
Remainder	1·028 ,,	1·285 ,,	1·080 ,,

The total weight of the bones (dried) is less than in normal animals; the percentage of fat in both bone and teeth is considerably over the normal, but the water is diminished. In animals to which calcium salts are not given, the fall in mineral salts is even more marked; and in periods longer than in the experiment quoted this is also the case. W. D. H.

Distribution of Assimilated Iron Compounds, other than Hæmoglobin and Hæmatins, in Animal and Vegetable Cells. By A. B. Macallum (*Proc. Roy. Soc.*, 1895, **57**, 261—262; see also *Proc. Roy. Soc.*, **50**, 277).—The reagent which proved to be of the greatest service for liberating the iron of assimilated compounds was freshly prepared ammonium hydrosulphide, made from a solution of ammonia of 0·96 sp. gr., and applied, mixed with glycerol, to the isolated cells in the way already described. Sulphuric, hydrochloric, and nitric acids dissolved in 95 per cent. alcohol liberate the iron of assimilated compounds, but the results obtained with these acids were controlled by experiments with the sulphide reagent when this was possible. The iron liberated is readily demonstrated as ferrous sulphide or as Prussian blue.

Iron, firmly combined, is a constant constituent of animal and vegetable chromatin. Another compound, less rich in iron, is found in nucleoli. The chromophilous substance in ferment-forming cells contains iron, and the cytoplasm of Protozoan organisms, which also probably secretes ferments, yields evidence of the presence of a firmly combined iron compound. A compound of iron is present in the chromophilous substance of the cytoplasm of fungi. Of the non-nucleated organisms, Bacteria, owing to their minuteness, have, with one exception, given little evidence of the presence of an organic iron compound; but in the Cyanophyceæ the chromophilous portions of the central substance contain iron, and iron is also present in the peripheral granules formed of the so-called cyanophycin.

E. C. R.

Nucleo-proteïds. By William D. Halliburton (*J. Physiol.*, 1895, **18**, 306—318).—The proteïd formerly termed β-cell-globulin by the author is really a nucleo-proteïd. This is true whether it is obtained from the stromata of the red blood corpuscles or from lymphoid structures like the thymus. On gastric digestion, it yields an insoluble residue of nucleïn, and its physiological action is similar to that of other nucleo-proteïds. Schmidt's fibrin ferment comes under the same category. It does not produce intravascular clotting, because the method of preparation, involving, as it does, the use of alcohol, leads to the formation of extremely dilute solutions, which, like all dilute solutions of nucleo-proteïd, causes a "negative phase," that is, a hindering influence on the coagulation of intravascular blood. Details of experiments are given, which support Pekelharing's contention that fibrin ferment is a calcium compound of nucleo-proteïd, and that the action of nucleo-proteïd in not promoting the coagulation of extravascular (salted) plasma is due to the inhibitory influence of the magnesium sulphate or other salt employed in the obtaining of the plasma. A number of phosphorus estimations in these and other varieties of nucleo-proteïd are also given, the amount of phosphorus in that of red marrow being especially high.

W. D. H.

Chemical Phenomena of Ossification. By P. Camille Chabrié (*Compt. rend.*, 1895, **120**, 1226—1228).—The author has previously found (Abstr., 1894, ii, 325) that the conversion of the fundamental cartilagenous matter into the fundamental osseous matter is the result of a simultaneous oxidation and the substitution of the amido-group for the hydroxyl group, the change being brought about by the influence of ammonia or ammonium salts in an alkaline medium, but not in presence of lactic acid. The same change seems to be brought about in the organism by urea in consequence of its ready convertibility into ammonium salts. Ammonium carbonate destroys the blood corpuscles, with liberation of lecithin, which acts as a feeble base and combines with carbonic acid. If lecithin, emulsified in water, is added to a mixture of sodium hydrogen phosphate and sodium hydrogen carbonate, to which some calcium chloride has been added, a precipitate of calcium carbonate and phosphate is formed, owing to the combination of the lecithin with the carbonic acid that would otherwise keep them in solution. It would seem, therefore, that the lecithin set free by the destruction of blood corpuscles is one of the main causes of calcification. In presence of lactic acid, as in cases of osteomalagia, this precipitation of calcium salts could not take place, and the action of the acid on the lecithin would liberate fatty acids, which are always present in such cases. The presence of relatively high proportions of magnesium salts under the same conditions arises from the fact that the solubilities of calcium and magnesium salts of fatty acids are practically the same in dilute solutions of lactic acid, whereas in normal ossification the conditions are not such as favour the precipitation of magnesium salts.

C. H. B.

Composition of the Bones, Teeth, &c., of Wild and Tame Rabbits. By Hugo Weiske (*Landw. Versuchs-Stat.*, 1895, **46**, 233—238; compare Abstr., 1894, ii, 287).—A comparison of wild and tame rabbits showed that whilst the former had the larger proportion of flesh and the smaller proportion of bones, the amount of digestive organs was almost identical in both. The skeleton of the wild rabbits contained on the average, 29·2 per cent. of water and 8·5 per cent. of fat, that of the tame rabbits 37·9 per cent. water and 8·6 fat. The amount of organic matter, total ash, and ash constituents was determined in the teeth, in the long tubular bones, and in the other bones. Variations occur in the composition of the bones of both tame and wild rabbits. The bones, especially the long tubular bones of the wild rabbits, contain more total ash than those of the tame rabbits, the difference being most marked in the case of lime and carbonic anhydride. The composition of the teeth is much more constant, but the teeth of wild rabbits seem to contain rather less mineral constituents than those of tame rabbits. It is possible that the age (which was not known) of the wild rabbits had something to do with the amount of calcium carbonate (compare L. Graffenberger, Abstr., 1891, 1275). N. H. J. M.

Paranucleïn in the Animal Organism. By W. Sandmeyer (*Zeit. physiol. Chem.*, 1895, **21**, 87—88).—Paranucleïn was prepared from caseïn; it contained 0·156 per cent. of phosphorus, which was almost exclusively in organic union. This was given to a dog; the urine in the 24 hours contained from 0·33 to 0·37 grams of phosphoric anhydride, but after the administration of paranucleïn it rose to 1·34 on one, and 1·84 on another, occasion. This shows that the phosphorus in organic form in caseïn is absorbed from the alimentary canal, and fits in with recent researches, which have shown that the phosphorised compound in caseïn is dissolved in the stomach partly, and by the pancreatic juice almost entirely. W. D. H.

Uric Acid Excretion. By KARL DAPPER (*Chem. Centr.*, 1895, i, 163; from *Therap. Monatsh.*, **8**, 522).—The absolute amount of uric acid excreted varies greatly in the same individual and in different people. Its relationship to the total nitrogen varies with the different percentages of proteïd in the food from 23·2 to 122·4. There is, moreover, no relationship between uric acid and body weight; for 100 kilos. of the latter, the former varies from 0·528 to 1·829 grams. E. Pfeiffer's figures are criticised. W. D. H.

Acidity of Urine. By VICTOR LIEBLEIN (*Zeit. physiol. Chem.*, 1895, **21**, 97—108).—Polemical (compare this vol. ii, 279). W. D. H.

Levulose in Diabetes. By W. HALE WHITE (*Chem. Centr.*, 1895, i, 167; from *Zeit. Klin. Med.*, **26**, 332).—In three cases of diabetes mellitus, the administration of levulose was found to increase the amount of sugar in the urine, and some of this sugar was levulose. This is contrary to what Minkowski found. The amount of urine was also increased. Allowing for the amount of levulose in the urine, the rest of the sugar was lessened, and the patients gained weight. Inulin also increases the body-weight, but increases the output of sugar, and this increase is not wholly explicable by the increased intake of carbohydrate. W. D. H.

Levulose in Diabetes. By KARL GRUBE (*Chem. Centr.*, 1895, i, 167—168; from *Zeit. Klin. Med.*, **26**, 340—345).—In slight cases of diabetes, levulose can be given in large quantities without harm. The organism in this disease appears able to use this sugar better than any other. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Vegetable Assimilation and Respiration: The Carbonic Anhydride Exchanges of Plants. By F. FROST BLACKMAN (*Proc. Roy. Soc.*, 1895, **57**, 162—164, and 165—168).—The author describes an apparatus in which the evolution of carbonic anhydride by a single germinating seed, or by a small area of a foliage leaf, can be accurately estimated from hour to hour without a break, whilst for the same area of leaf the more active absorption of carbonic anhydride in assimilation can be easily determined for such short periods as 15 minutes, and that at the same time separately for the two surfaces of one and the same leaf area. The estimation of the carbonic anhydride is made by the well-known method of absorption by baryta solution and titration with hydrochloric acid. The apparatus is arranged so that this estimation can be carried out in the apparatus itself, and so that a current of air, either free from carbonic anhydride, or containing a definite quantity of the same, can be supplied continuously at atmospheric pressure to either surface of the leaf.

To determine the path of gaseous exchange between aërial leaves and the atmosphere, shallow capsules 10 sq. cm. in area are affixed to a leaf on opposite sides of the same area by means of soft wax, and then two continuous currents of air are kept up over the two surfaces, and the carbonic anhydride produced or taken in, during a given time, by each of them is determined. The results obtained show that under normal conditions practically the sole pathway for carbonic anhydride into, or out of, the leaf is by the stomata. Since oxygen diffuses more readily than carbonic anhydride through fine openings, the same probably holds for oxygen, and the whole of the gas exchange. Under abnormal conditions, when the stomata or intercellular spaces are blocked, and the surrounding tension of carbonic anhydride is great enough, passage of carbonic anhydride by osmosis through the cuticle may take place. Such closure of stomata as is held to take place in darkness does not prevent the distribution of gas exchange closely agreeing with that of the stomata. The exhalation of carbonic anhydride in bright light by a leafy shoot in Garreau's well-known experiment, is not the expression of any physiological truth for the leaf, but only due to the imperfections of the conditions, to the presence of immature parts, or of tissues not sufficiently green, or not fully illuminated. Mature isolated green leaves, fully illuminated, assimilate the whole of their respiratory carbonic anhydride, and allow none to escape from them. E. C. R.

Germination of Seeds. By TH. SCHLOESING, Jun. (*Compt. rend.*, 1895, **120**, 1278—1280.)—Wheat and white lupins were allowed to germinate in moist sand in a confined atmosphere, the volume and com position of which were accurately known. Oxygen was introduced from time to time, in order to maintain the proportion at about 21 in 100, but no carbonic anhydride was introduced. When the plants had attained considerable size, the gas in the vessels was withdrawn, measured, and analysed. The results show that during the germination of wheat and lupins, none of the nitrogen originally present in the seed is liberated in the gaseous form. C. H. B.

Utilisation of Elementary Nitrogen by Mustard. By THEODOR PFEIFFER and E. FRANKE (*Landw. Versuchs-Stat.*, 1895, **46**, 117—151). —After discussing and pointing out the inconsistencies in Liebscher's results (Abstr., 1894, ii, 201), the authors describe their own experiments made on similar lines. The plan followed was to grow, first peas, then mustard, in the same soil, under various conditions. There were three series, each of six pots. (I) sterilised; (II) sterilised, and then inoculated; and (III) not sterilised. The soil contained 0·0392 per cent. of nitrogen (= 10·584 grams per pot containing 27 kilos. of soil). Half of the pots of each series received 1·2 grams of nitric nitrogen for mustard; the necessary minerals were added.

As regards the pea experiment, there was no great difference in the amounts of dry produce, the average amount being 54·95 grams, containing an average amount of 1·30 grams of nitrogen. No satisfactory balance of total nitrogen could be obtained, owing to the difficulty of sampling.

In the mustard experiments, as in the case of peas, it was for the same reason impossible to obtain a balance of total nitrogen, but the results, taking the produce alone, were very regular and consistent, and the figures obtained from the three pots of each experiment agreed very nearly. The following are the average results.

Experiments.	Dry produce.	N. in produce.
1, 2, 3 without nitrate, sterilised	27·6	0·4323
7, 8, 9 „ „ „ and inoculated....	30·1	0·4276
13, 14, 15 „ „ not sterilised.......	14·8	0·1546
4, 5, 6 with nitrate sterilised	71·2	1·4688
10, 11, 12 „ „ „ and inoculated	68·5	1·5169
16, 17, 18 „ „ not sterilised..........	63·4	1·1938

The effect of nitrate is thus very marked.

The higher results obtained in the pots which had been sterilised as compared with those of the pots which were not sterilised are, no doubt, due to the action of the heated steam by which the soil constituents were rendered more soluble. In comparing the effect of nitrate on the amount of nitrogen in the produce, this inequality may be eliminated by deducting the total nitrogen of the sets which had no nitrate, from that of the corresponding sets which had nitrate; the resulting figures then show the increase due to nitrate: sterilised, 1·0365; sterilised and inoculated, 1·0893 (?1·0393); not sterilised, 1·0392 gram. The results are practically identical, and show that soil bacteria were without effect on the yield of nitrogen. The nitric nitrogen applied was 1·2 gram; the average amount of nitrogen in the produce due to nitrate added was 1·055 gram; this excess is therefore fully accounted for without assuming fixation to have taken place. The results point to the conclusion that mustard cannot utilise elementary nitrogen.

It is hoped in subsequent experiments, by means of more perfect sampling, to obtain a satisfactory balance of total nitrogen, although, owing to the fact that nitrogen fixation may take place in soil, such a nitrogen balance is not essential.

N. H. J. M.

Influence of the Root-nodules of Alnus Glutinosa on the Fixation of Nitrogen. By Lorenz Hiltner (*Landw. Versuchs-Stat.*, 1895, **46**, 153—161).—The results of the author's experiments with the common alder point to the following conclusions. The plants do not develop in absence of combined nitrogen, unless provided with root nodules, whilst with root nodules the plants utilise free nitrogen similarly to the *Papilionaceæ*. In presence of combined nitrogen in the soil, the production of nodules is hindered, or may be stopped altogether; nodules are, however, formed in increased amount as the soil becomes poorer in available nitrogen. The organism which produces nodules in the alder roots acts as a parasite until the nodule is fully developed, after which the plant benefits.

Unlike the pea nodules, the alder nodules are effective in water cultures; addition of nitrate to such cultures hinders or stops the development of the nodules.

R. Dinger (*Landbouwkund. Tijdschr.*, 1895, **3**, 167—192) also concluded that the alder assimilates free nitrogen when provided with root nodules.

N. H. J. M.

Composition of the Root Nodules of the Alder. By Adolf Mayer (*Landbouwkund. Tijdschr.*, 1895, **3**, 319—320).—The following numbers show the percentage composition of (1) the nodules, (2) the roots of the alder in the dry state.

	Crude proteïn.	Proteïn.	Nitrogen free* extract.	Crude fibre.	Ash.
(1)	9·8	(8·3)	64·6	17·4	8·2
(2)	5·7	(5·4)	60·5	31·8	2·0

Troschke found the following percentage amounts in the dry matter of (1) the nodules, (2) the roots of blue lupins.

	Crude proteïn.	Proteïn.	Nitrogen free extract.	Crude fibre.	Crude fat.	Crude ash.
(1)	45·3	31·6	32·5	9·4	5·3	7·5
(2)	7·1	5·2	34·6	52·9	1·3	4·1

The crude ash of the lupin nodules and roots contained K_2O (1), 16·6; (2), 12·8; P_2O_5 (1), 16·19; (2), 8·84 per cent. (*Wochenschr. d. Pommersch. ök. Ges.*, 1884, No. 19, and Abstr., 1885, 420).

N. H. J. M.

Cane Sugar in Plants. By Ernst Schulze and S. Frankfurt (*Zeit. physiol. Chem.*, 1895, **20**, 511—555; **21**, 108).—The chemical part of this paper has been previously published (Abstr., 1894, i, 154). With regard to the physiological uses of cane sugar, the general conclusion is drawn that it is not only a most valuable reserve material in plant life, but that it also plays a very important *rôle* as a circulating condition (*Wanderungsform*) of starch. It is almost always accompanied by other soluble forms of carbohydrate, but these are not regarded as having the same function as cane sugar, as the nature and amount of these other carbohydrates vary considerably in different vegetables. They are possibly reserve stuffs, and probably are changed during the life of the plant into cane sugar.

In the second paper, the authors make a correction. They previously said that from cane sugar and three other carbohydrates, invertin was able to form glucose. This was written previous to Fischer's work on invertin (this vol., i, 161, 141; ii, 322). Instead of invertin, it would be now better to say a preparation of enzymes from yeast, for such preparations probably contain several enzymes.

W. D. H.

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* Including a little fat.

Origin of Unsaturated Compounds in Plants. By CHARLES F. CROSS, EDWARD J. BEVAN, and CLAUD SMITH (*Ber.*, 1895, **28**, 1940—1945).—See this vol., i, 640.

Chemical Investigation in Plant Pathology. By JULIUS STOKLASA (*Zeit. Physiol. Chem.*, 1895, **21**, 79—86).—The chemical processes investigated are those occurring in the sugar beet when attacked by the parasitic nematode, *Heterodera Schachtii*, the production of saccharose being lessened; in damp soil, the injurious effect of the parasite is doubled. The fundamental change appears to be in the living molecules, leading to a partial oxidation of the circulating proteïd of the plant protoplasm; the proteïd in the leaves sinks, whilst the asparagine (or glutamine) is increased. W. D. H.

The Tobacco Plant. By J. BEHRENS (*Landw. Versuchs-Stat.*, 1895, **46**, 164—192).—In the process of drying tobacco leaves by keeping them in heaps, the whole becomes heated in the same manner as malt, &c. The so-called "scalding" of the leaves is not caused through the killing of the leaves by heating, but through the poisonous effect of the accumulation of carbonic anhydride, and perhaps, in part, by the action of micro-organisms. The only advantage of the process over the ordinary drying process seems to be the saving of time. In both processes, the leaves contain the same percentage of total nitrogen, but in the heated leaves, a much larger proportion of the nitrogen is in the form of proteïds. This is connected with the conversion of the starch into sugar, observed in leaves dried in masses, it being supposed that the sugar reacts with the products of decomposition of the proteïds to re-form proteïn.

An examination of the moulds and bacteria of tobacco leaves, and of snuff, was made. The manufacture of snuff is discussed, and suggestions made for improving the quality of tobacco.

N. H. J. M.

Behaviour of Phosphoric acid, Soluble in Water, towards the Absorbent Constituents of Soil. By MAX GERLACH (*Landw. Versuchs-Stat.*, 1895, **46**, 201—219).—For estimating the available phosphoric acid, extraction with 1 per cent. citric acid solution was found very suitable for the great majority of soils (compare Dyer, Trans., 1894, 115). It frequently occurred, however, that soils which were not benefited by applying superphosphate yielded comparatively small quantities of phosphoric acid by this method; this was especially the case with light, sandy soils. Only one case was observed in which a soil yielding a good deal of phosphoric acid when treated with citric acid, gave a heavier crop when manured with superphosphate. Attempts to explain these unexpected results have not yet been entirely successful.

As regards the effect of soil constituents (compare A. Thomson, *Verhalten d. Sandbodens gegen Superphosphat*) in retaining soluble phosphates, the results of experiments now recorded, show that clay, peat, and sand which have been extracted with hydrochloric acid have no power of absorbing free phosphoric acid, sodium phosphate, or superphosphate; calcium and magnesium carbonates both absorb phosphoric acid applied in the three forms, whilst alumina and ferric hydroxide do so very completely. Sodium phosphate is the least readily retained. The phosphoric acid so absorbed by the two carbonates is comparatively readily soluble, and is completely extracted by water containing carbonic anhydride. Phosphoric acid absorbed by ferric hydroxide and alumina becomes insoluble in water, even in presence of carbonic anhydride, but is more or less completely dissolved by the prolonged action of dilute organic acids.

Experiments were next made to ascertain in what form the phosphoric acid is absorbed. When a solution of hydrogen calcium phosphate comes into contact with calcium carbonate, di- and tricalcium phosphates are produced, according to the amount of calcium carbonate present (compare Stoklasa, Abstr., 1893, ii, 549). When ferric hydroxide and alumina are the absorbents, not only the phosphoric acid, but the lime is also precipitated; dicalcium phosphate and an iron (or aluminium) phosphate are formed. An air-dried mixture of ferric hydroxide, ferric phosphate, and dicalcium phosphate, when mixed with sand and extracted with carbonic acid water, gave up the whole of the lime, but practically no phosphoric acid.

Four lots of soil (each 100 grams) were treated with 1 litre of 1 per cent. acetic acid. When filtered immediately, 0·0145 gram of P_2O_5 was dissolved, whilst when the action was continued for 3 hours, 24 hours, and 14 days respectively, 0·0103, 0·0079, and 0·0024 gram of P_2O_5 were dissolved, the effect of the acetic acid being to dissolve at once the more readily soluble phosphates, which were then gradually fixed by the alumina or ferric hydroxide in the soil (compare Wagner, *Journ. f. Landw.*, 1871, 100). An action similar to that described might be imagined to take place in a soil manured with superphosphate, the solvent in this case being water and carbonic anhydride (compare Georgieris, *Chem. Zeit.*, 1891, 1626). A loamy soil, containing CaO 0·86, P_2O_5 0·086, per cent. (insoluble in citric acid) was saturated with a solution of superphosphate; when extracted with water containing carbonic anhydride, a large quantity of lime was dissolved, but no phosphoric acid. Under natural conditions, the process would, no doubt, be much slower.

N. H. J. M.

Analytical Chemistry.

Valve Pipette. By OSCAR BOCK (*Zeit. anal. Chem.*, 1895, **34**, 432—433).—The pipette body is of the ordinary form, but instead of the narrow upper tube it is fitted with a rod, sliding in a detached guide tube, and ground at its lower end to a conical valve; this fits into a seat at the summit of the pipette body, and by its means the top of the pipette can be opened or closed. M. J. S.

Potassium Hydrogen Iodate in Volumetric Analysis. By C. MEINEKE (*Chem. Zeit.*, 1895, **19**, 2—7).—Potassium hydrogen iodate,

KHI_2O_6, is recommended by the author for the standardising of various volumetric solutions, on account of its great purity and stability. Mixed with a large excess of potassium iodide and a sufficiency of hydrochloric or sulphuric acid, its molecule liberates 12 atoms of iodine, and the solution may then be used in all cases where volumetric iodine is wanted. Mixed with potassium iodide without acid, part of its iodine is set free, and may be removed by means of sodium thiosulphate. The resulting solution when acidified liberates a further amount of iodine, dependent on the quantity of acid added; the compound is therefore useful in acidimetry. The acid nature of the salt makes it also suitable for the standardising of alkaline reagents, best with phenolphthaleïn as indicator.

L. DE K.

New Reactions of Hydrogen Peroxide. By LUDWIG ILOSVAY DE NAGY ILOSVA (*Ber.*, 1895, **28**, 2029—2031; compare this vol., ii, 239).—The application of aniline in acid solution mixed with potassium dichromate as a test for the presence of hydrogen peroxide, has been already described by A. Bach (*loc. cit.*); the author's experiments show that dimethylaniline, paramidobenzenesulphonic acid, ortho- and para-toluidine, tolylenediamine, xylidene, and naphthylamine may be advantageously employed, whilst diphenylamine and methyldiphenylamine give no characteristic coloration.

Particulars of the reactions are collected in the following table.

Reagent.	Dilution.	Reaction.
Aniline.................	1 in 1,000,000	Pale violet after 3 minutes.
Dimethylaniline	1 in 1,000,000	Yellow after one minute.
,, ...	1 in 5,000,000	Yellow after 5 minutes.
Paramidobenzenesulphonic acid	1 in 1,000,000	Reddish-violet after 1 minute.
Orthotoluidine...........	1 in 1,000,000	After 6 minutes becomes yellow, then green.
Paratoluidine............	1 in 1,000,000	Coppery-red after 5 minutes.
Tolylenediaimne	1 in 1,000,000	Pale rose-red after 2 minutes.
Xylidine	1 in 1,000,000	Rose-red after 3—4 minutes; reddish violet after 5 minutes.
Naphthylamine..........	1 in 1,000,000	Becoming colourless after 3 minutes, is bluish-violet at the end of 10—12 minutes.

M. O. F.

Gas Volumetric Estimation of Hydrochloric acid in the Contents of the Stomach. By V. MIERCZYNSKI (*Chem. Centr.*, 1895, i, 131—132; from *Centr. innere Med.*, **15**, 1073—1077).—A measured quantity of gastric juice (5—20 c.c.) is evaporated to dryness in a porcelain crucible, with the addition of barium carbonate. The residue is ignited, and the ash extracted with boiling water. If this solution should turn red with phenolphthaleïn, air must be passed through until the free baryta has been neutralised. The liquid, which contains barium chloride, is precipitated by means of a small excess of ammonium chromate, and the barium chromate well washed with hot, very dilute ammonia. It is then rinsed with warm, dilute hydrochloric acid (1—20) into the outer container of Wagner's nitrometer, and mixed with 10 c.c. of dilute sulphuric acid. It is then, in the usual way, brought into contact with 10 c.c. of solution of hydrogen peroxide, and the liberated oxygen is finally measured. One molecule of oxygen represents 1 mol. of hydrochloric acid. The results are correct. L. DE K.

Detection and Estimation of Chlorate in Bleaching Powder. By C. REMIGIUS FRESENIUS (*Zeit. anal. Chem.*, 1895, **34**, 434—436).—In Pattinson's experiment on the formation of chlorate in bleaching powder when kept (Abstr., 1888, 552), the chlorate was estimated by a differential method, and the results presented anomalies. A direct estimation can be made by allowing the hypochlorite to react with lead acetate, when the following reactions occur:—$Ca(ClO)_2 + PbCl_2 = PbO_2 + CaCl_2 + Cl_2$, and $2Pb(C_2H_3O_2)_2 + Cl_2 + 2H_2O = PbCl_2 + PbO_2 + 4HC_2H_3O_2$. Twenty grams of the bleaching powder is rubbed up with water, made up to a litre, and filtered. Fifty c.c. of the clear filtrate is mixed in a flask with excess of neutral lead acetate. When no more precipitate can be obtained on further addition of lead acetate, the mixture is allowed to remain in an unclosed flask until the odour of chlorine has completely disappeared, which will be the case after 8—10 hours, and is then filtered. For qualitative testing, the lead is removed by adding a small excess of dilute sulphuric acid and filtering; a little indigo is then added, and sulphurous acid solution drop by drop, when the chloric acid is reduced to substances which bleach the indigo. For quantitative estimation, the precipitate of lead peroxide and chloride is washed; the washings are concentrated and the solution mixed with a small excess of sodium carbonate. The soluble matters are washed out of the precipitate, and the filtrate after being evaporated almost to dryness, is distilled with concentrated hydrochloric acid into potassium iodide. M. J. S.

Estimation of Sulphur in Iron. By MORITZ A. v. REIS (*Chem. Centr.*, 1895, i, 129—130; from *Stahl u. Eisen*, 1894, 963—966).—The author recommends the process by which the sulphur is evolved as hydrogen sulphide and then oxidised by means of hydrogen peroxide in ammoniacal solution. The following precautions should be observed:—The solvent should consist of hydrochloric acid (sp. gr. 1·19) diluted with an equal bulk of water, and the distillation should be stopped when the liquid becomes thick and begins to froth. Care must be taken to have pure hydrogen peroxide, hydrofluosilicic acid being especially objectionable. To expel the last traces of gas, a current of hydrogen, or even a slow current of air, may be employed, but carbonic anhydride is not to be recommended, as this seems to prevent full oxidation. As small quantities of sulphuric acid are oxidised to persulphuric acid, which is not precipitated by baryta, this and the excess of hydrogen peroxide must be completely destroyed by boiling with hydrochloric acid and adding a slight excess of potassium permanganate, which is then in turn cautiously removed by adding a little oxalic acid solution. If the amount of sulphate is very small, the separation of the precipitate will be promoted by adding an accurately measured quantity of sulphuric acid of known strength. The washed and ignited barium sulphate does not, as a rule, require purification. L. DE K.

Estimation of Sulphur in Iron. By LUCIEN L. DE KONINCK (*Chem. Zeit.*, 1895, **19**, 502).—The author believes that although air does not readily oxidise hydrogen sulphide, yet it quickly oxidises the ferrous chloride, which then in turn acts on the hydrogen sulphide, and so causes a loss by precipitating sulphur. He therefore advises dissolving a little tin in the hydrochloric acid previous to use, so as to prevent the oxidation of the iron solution. There is no danger of any tin sulphide being formed if the acid is only strong enough.

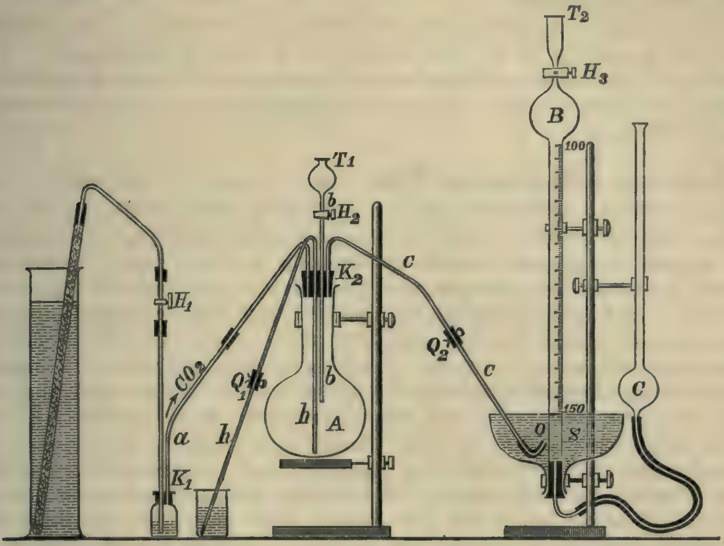
L. DE K.

Estimation of the total Sulphur in Urine. By PAUL MOHR (*Zeit. physiol. Chem.*, 1895, **20**, 556—561).—In estimating the total sulphur in urine, three methods were employed, and parallel experiments made with the same quantity of urine in each case. In one method, that of Liebig, the urine is fused with potassium hydroxide and nitrate; in the second, that of Carius, the urine is heated with fuming nitric acid in a sealed tube; in the third method, the one now proposed, 10 c.c. of urine is treated with 15 c.c. of fuming nitric acid in the cold. The first and second methods give approximately the same results, and are usually somewhat higher than the results obtained by the third method, which is regarded as the best. W. D. H.

Kjeldahl's Process of Estimating Nitrogen in Foods. By A. BÖMER (*Chem. Zeit.*, 1895, **19**, 166—167).—The author recommends boiling the sample with sulphuric acid and a little mercury in the same flask, which afterwards serves for the distillation. In the case of cotton-seed and similar meals, 10 hours' boiling is required to obtain all the nitrogen as ammonia.

When phosphoric anhydride is added, the action is complete in four hours. L. DE K.

Estimation of Nitric acid. By RICHARD BERGER (*Chem. Zeit.*, 1895, **19**, 305—306).—The process is based on the well-known conversion of nitric acid into nitric oxide. The following reagents, free from air, are required:—Hydrochloric acid of sp. gr. = 1·09; concentrated solution of ferrous sulphate; sulphuric acid of sp. gr. = 1·75, and aqueous potash of sp. gr. = 1·16. The chief part of the apparatus is the 200—250 c.c. Flask A which contains a few platinum cuttings, and in the 20-mm. wide neck of which a quadruply perforated indiarubber cork, K_2 is fitted. This is connected with the carbonic anhydride delivery tube *a*, the syphon *h* with pinchcock Q_1, the tube *b* with a tap H_2 and funnel T_1, and, lastly, with the tube *c*, having a pinchcock Q_2 and ending in a bend O, which is covered with a piece of indiarubber. It is important that the taps H_1, H_2, and H_3 shall turn easily, and also that the tubes *a* and *c* shall not protrude from the bottom of the corks K_1 and K_2.



The air from the apparatus is first displaced by a current of carbonic anhydride and of water vapour which is generated in A; H_1 and Q_2 being opened, H_2 and Q_1 closed. The parts of *b* and *h* which are not traversed by the gas are filled with water, *b* from T_1, by opening and then closing H_2; *h*, by opening Q_1, at the same time closing Q_2. In the trough S is poured some water free from air, and the burette B is filled by opening H_3 and then lifting the pipette C; the curved end of the tube *c* is then inserted into the opening O of the burette, which must be at a height of about 30 mm. from the bottom. As soon as the gas is completely absorbed by aqueous potash which is admitted from T_2 by opening H_3, the source of heat from the flask is removed, the latter is emptied by opening Q_1, the syphon being, however, left filled. Q_2 and H_1 are also closed.

Estimation of Nitre.—After the apparatus is freed from air, the flask is charged by means of *b*, first with 10 c.c, of iron solution, then 25 c.c. of nitrate solution containing about 0·5 gram of solid matter, then again 10 c.c. of iron solution, followed by 25 c.c. of sulphuric acid, and finally once more 5 c.c. of iron sulphate. After shaking, the tap H_1 is permanently, but not fully, opened. After a while warming is resorted to, Q_2 is opened, and the heat so regulated that the bulk of the nitric oxide passes off in about five minutes. The gas collecting in the burette is freed from carbonic anhydride by admitting from time to time aqueous potash from T_2. When the iron solution has turned pure yellow, the flame is removed, Q_2 and H_1 are closed, and a few more cubic centimetres of iron solution are admitted into A, the mixture being again boiled for five minutes; a rapid stream of carbonic anhydride is passed at the same time so as to ensure the complete expulsion of the nitric oxide. The burette is now placed in a cylinder filled with water free from air, and the gas is measured with the usual precautions.

By closing Q_2 and emptying the flask by opening Q_1 and closing H_1, the apparatus is at once ready for a second experiment. The process is, of course, applicable to sulphuric acid mixed, or contaminated, with nitric acid. The test analyses prove the great accuracy of the process. L. DE K.

Eggertz's Phosphorus Test. By HANNS V. JÜPTNER (*Chem. Centr.*, 1894, ii, 449—450; from *Österr. Ung. Zeit. f. Berg. u. Huttenroesen*, **42**, 361—366).—The author gives the following modification of Eggertz's process, working without a centrifugal apparatus. 0·882 gram of the sample is dissolved in hot hydrochloric acid, oxidised with potassium permanganate, and any manganic dioxide dissolved by means of a few grains of oxalic acid. The liquid is then heated to 40°, mixed with 50 c.c. of molybdate solution, thoroughly shaken, and allowed to subside for a few hours. After syphoning off the clear supernatant fluid, the precipitate is transferred to the measuring tube, which is then placed in a shaking apparatus constructed on the principle of a stamping mill, which will cause the precipitate to be compressed. The author states that the results are very trustworthy when the precipitate looks a pure deep yellow and when its volume is nearly the average. If the sample is rich in silicon, this should be first removed; if very poor in phosphorus, a larger quantity should be weighed out. Admixture of arsenic is not to be feared if the temperature during the precipitation does not exceed 40—45°. L. DE K.

Correct Estimation of Phosphorus in Iron and Steel. By LIEBRICH (*Chem. Centr.*, 1895, i, 234; from *Stahl u. Eisen*, 1894, 1028—1029).—0·5—5 grams of the sample is dissolved in nitric acid (1·2 sp. gr.) and evaporated to dryness to render silica insoluble. The residue is dissolved in hydrochloric acid, diluted with water, and the metals precipitated by adding ammonia and ammonium sulphide. After warming, the liquid is filtered and the precipitate washed with hot dilute ammonium sulphide. The filtrate is mixed with a little magnesia mixture and then evaporated to dryness in a platinum dish. The residue is calcined to expel ammoniacal salts, then dissolved in hydrochloric acid, and the phosphoric acid precipitated as triple phosphate by adding ammonia. If arsenic or antimony is suspected, the acid solution is first freed from these metals by means of hydrogen sulphide. The results obtained by the author's process correspond with those got by the molybdate method. L. DE K.

Estimation of Phosphoric acid with Molybdate. By JOSEPH HANAMANN (*Chem. Zeit.*, 1895, **19**, 553—554).—The author prepares his molybdate solution by dissolving 100 grams of molybdic acid in 1 litre of 10 per cent. ammonia and pouring this into 1·5 litre of nitric acid of sp. gr. 1·246. The precipitate which forms in the cold is washed with acid ammonium nitrate and nitric acid, and collected on a Schleicher filter. It is then transferred to a platinum crucible and ignited, heating to actual redness being avoided, until it is uniformly blue-black. The paper is burnt separately. The ignited compound contains 4·018 per cent. of phosphoric anhydride. L. DE K.

Estimation of small quantities of Arsenic. By ADOLPHE CARNOT (*Compt. rend.*, 1895, **121**, 20—22).—The arsenic is precipitated as sulphide, converted into arsenic acid, and weighed as bismuth arsenate, which, when dried at 110°, has the composition $2BiAsO_4 + H_2O$. The precipitate of arsenic sulphide, mixed with more or less sulphur, is treated with warm ammonia solution, and the filtered liquid is mixed with excess of silver nitrate solution and heated for a short time. If silver nitrate solution no longer produces a precipitate, a small quantity of hydrogen peroxide solution is added and the liquid is heated at about 100° until all the ammonia is expelled. It is then slightly acidified with nitric acid, filtered, and mixed with excess of bismuth nitrate solution. An excess of ammonia is next added, the liquid boiled for a short time, the clear liquid decanted through a weighed filter, and the precipitate boiled with a mixture of nitric acid of sp. gr. 1·33 with an equal volume of water. The heavy, crystalline, insoluble precipitate is collected on a weighed filter, washed with dilute nitric acid (1 : 15) and finally with water, and dried at 110°.

Experiments with 10 c.c. of liquid containing 0·002976 gram of arsenic gave ±0·2 milligram as the greatest error, the usual error being not more than 0·05 milligram. C. H. B.

Titration of Arsenious acid by Permanganate. By LUDWIG VANINO (*Zeit. anal. Chem.*, 1895, **34**, 426—431).—In spite of the brown coloration obtained when permanganate is added to a solution of arsenious acid, a very accurate titration can be obtained by working in a solution acidified with sulphuric acid and warmed to 70°, and taking as the end of the titration the point at which the mixture assumes a persistent, reddish-violet colour. It is, however, far more convenient to add a measured excess of permanganate (whether in the cold or at 70° is not indicated), and titrate the excess with a solution of hydrogen peroxide until the liquid becomes colourless, the end being quite sharp, and the results practically identical with those obtained by iodine titration. M. J. S.

Estimation of Carbon in Iron. By LEOPOLD SCHNEIDER (*Chem. Centr.*, 1895, i, 134; from *Stahl u. Eisen*, 1894, 1029).—Three grams of steel borings is mixed with 10 grams of a mixture of three parts of lead powder and one part of copper powder and introduced into a porcelain boat, which is then put into a combustion tube. It is advisable to rest the boat on some asbestos. In front is placed a 10—20-cm. layer of copper oxide, and the combustion is then made, as usual, in a current of pure oxygen. The operation lasts about 45 minutes, the lead and copper serving as indirect oxidisers.

L. DE K.

Analysis of Liquefied Carbonic Anhydride. By LEO GRÜNHUT (*Chem. Zeit.*, **19**, 1895, 505, 555).—In testing liquid carbonic anhydride, it is not sufficient to make an ultimate analysis of the gas which escapes on opening the tap of the bomb, as such an analysis is nearly always satisfactory, but the author advises examining the contents of the bomb after all the gas has escaped. In several cases, a quantity of discoloured liquid was found, chiefly consisting of glycerol, iron oxide, and organic matter of unpleasant odour. L. DE K.

Potassium Tetroxalate for Titrating Alkalis. By ARTHUR BORNTRÄGER (*Zeit. anal. Chem.*, 1895, **34**, 431—432).—The researches of Wells, Hinman, and Frear confirm the suspicion expressed by the author when advocating the use of potassium hydrogen tartrate for the above purpose, that potassium tetroxalate is difficult to prepare pure, is liable to effloresce when hydrated, and is hygroscopic when dehydrated. M. J. S.

Estimation of Alkalinity in Raw Sugars. By M. NEVOLE (*Chem. Centr.*, 1894, ii, 456; from *Österr. Ung. Zeit. Zucker. Ind. u. Landw.*, 1894, **3**).—The author recommends Poupě's process, which involves the use of perfectly neutral litmus. This indicator is preferable to rosolic acid, recommended by Sachs. L. DE K.

Detection and Estimation of Sodium in Lithium Salts. By ISAAC W. THOMSON (*Zeit. anal. Chem.*, 1895, **34**, 451—452; from *Chemist and Druggist*, **36**, 240).—Whilst one part of sodium chloride requires for solution 600 parts of strong hydrochloric acid, lithium chloride is freely soluble. That a method of estimation depending on this fact can give good results is shown by the following experiment. Ten grams of lithium carbonate mixed with 2 per cent. of sodium carbonate were made up with water to 100 c.c., boiled, cooled, and made up to the original volume. Fifty c.c. of the filtrate was evaporated to dryness, and the residue treated with 15 c.c. of strong hydrochloric acid saturated with sodium chloride. After cooling, the chloride was thrown on a filter, washed first with 10 c.c. of the same liquid and then with pure hydrochloric acid. The residue, dissolved in water and evaporated to dryness, yielded 0·11 gram of sodium chloride, thus agreeing exactly with the 2 per cent. of sodium carbonate taken. The ether-alcohol method gives equally satisfactory results, but only in the absence of sulphates, whilst the above method is not affected by their presence. M. J. S.

Separation of Mercury from the Metals of the Arsenic and Copper Groups. By CARL v. USLAR (*Zeit. anal. Chem.*, 1895, **34**, 391—413).—The method of Polstorff and Bülow (Abstr., 1891, 1292) fails to separate mercury from cadmium or tin That of H. Rose (precipitation of the mercury as mercurous chloride by phosphorous acid) has been found in some cases to give a deficiency in the quantity of mercury found. The author has submitted this method to a more minute examination, and finds that the mercury can be completely precipitated from a solution containing all the metals of the above groups with the exception of tin, as the chlorides of this metal dissolve mercurous chloride. From copper, cadmium, arsenic, and antimony, the separation is complete, but in the case of bismuth or lead, traces are precipitated with the mercurous chloride, and a further separation by Polstorff's method is required. Except in the case of bismuth, when the addition of nitric acid must be avoided, the precipitation is best performed in a solution strongly acidified with nitric acid (25 c.c. of a 25 per cent. acid to 150 c.c. of the solution), since under these circumstances, as also in solutions only feebly acidified with hydrochloric acid, no reduction to metallic mercury ensues, whereas in solutions containing much hydrochloric acid a partial reduction of the mercurous chloride takes place, and a loss of mercury by volatilisation is possible. The solution is heated to 40—45°, 5 c.c. of a 20 per cent. solution of phosphorous acid for each decigram of mercuric chloride present is then added, and the mixture is kept at 40° for 5—6 hours. The precipitated mercurous chloride is washed with dilute acid (hydrochloric or nitric according to circumstances) and the filtrate again warmed with phosphorous acid for a few hours. The precipitate is then dissolved by hydrochloric acid and potassium chlorate, and the mercury precipitated by hydrogen sulphide; the precipitate is then purified if necessary by Polstorff's method (solution in a mixture of potassium sulphide and hydroxide, and reprecipitation from the filtered solution by ammonium chloride), and the sulphide once more dissolved by hydrochloric acid and chlorate; after the chlorine has been expelled by warming, the mercury is finally precipitated by hydrogen sulphide (with Polstorff's precautions, see *Arch. Pharm.*, **229**, 294) and dried on a weighed filter.

M. J. S.

Estimation of Aluminium in Phosphates. By HENRI LASNE (*Compt. rend.*, 1895, **121**, 63—66).—The mineral should be treated with hydrochloric acid, and the solution evaporated to dryness in contact with the residue in order to decompose the fluorides and make the silica completely insoluble, since both would interfere with the determination. The residue is redissolved in the smallest possible quantity of hydrochloric acid and the solution diluted with 20 times its volume of water.

Aluminium phosphate is distinctly soluble in dilute acetic acid, but is insoluble in water containing ammonium chloride and a very slight excess of free ammonia. Ammonium thiosulphate readily precipitates the phosphate in a granular form, but the composition of the precipitate varies with that of the liquid in which it is produced. If, however, ammonium phosphate is added to a solution in such quantity that the liquid contains an excess of from 0·6 to 1·0 gram of phosphoric anhydride per litre, the composition of the precipitate corresponds exactly with normal aluminium phosphate.

Sodium hydroxide dissolves aluminium hydroxide in presence of an excess of phosphoric acid, whilst calcium, magnesium, iron, and manganese are precipitated. An excess of phosphoric acid is necessary in order to prevent the formation of a calcium aluminate, which is not decomposed by sodium hydroxide. Care must be taken that sodium carbonate is not formed during the washing of the precipitate.

The feebly acid solution of 1·25 gram of the phosphate free from silica is mixed with excess of sodium hydroxide free from silica and alumina, and sufficient sodium phosphate to provide an excess of phosphoric acid, and heated at 100° in a nickel dish for about an hour. The volume of the liquid is then made up to 250 c.c., and 0·5 c.c. is added to correct for the volume of the precipitate. The liquid is filtered, and 200 c.c., corresponding with 1 gram of the phosphate, is used for subsequent operations; this is acidified, and mixed with ammonium chloride and a slight excess of ammonia. The precipitate thus formed is drained, and redissolved in hot dilute hydrochloric acid, the solution being afterwards mixed with 3·5 c.c. of an ammonium phosphate solution (1 : 100), very nearly neutralised with ammonia, and diluted to about 250 c.c. 1·5 grams of ammonium thiosulphate is then added, the liquid boiled for half an hour, mixed with a few drops of a saturated solution of ammonium acetate, and again boiled for 10 minutes. The precipitate is washed with hot water, and heated with a blowpipe flame for 15 minutes. C. H. B.

Detection of Iron in Commercial Copper Sulphate. By Gioachino Griggi (*Zeit. anal. Chem.*, 1895, **34**, 450; from *Boll. chim. farm.* through *Zeit. allgem. Oesterr. Apothekervereins*, **47**, 863).—Five c.c. of the aqueous solution (1 : 5) is covered in a test-tube with 5 c.c. of an ethereal solution of salicylic acid (1 : 10). The contact layer acquires a violet colour, the depth of colour depending on the proportion of iron present. M. J. S.

Colorimetric Assay of Cobalt Ores. By Knieder (*Chem. Centr.*, 1894, ii, 452; from *Rev. Minera*, 1893, 398).—Twelve 200 c.c. flasks of the same calibre are selected. Eleven of them are filled with solutions of cobaltous chloride of increasing strength, varying from 0·1 to 2 grams of the crystallised salt. Twenty-five grams of the powdered ore is dissolved in a sufficiency of hydrochloric acid, the solution is diluted to 750 c.c., neutralised with chalk, and then diluted to 1 litre. Two hundred c.c. of the filtrate is now compared in the 12th 200 c.c. flask with the standard samples. If the ore is ferruginous or contains copper, the colour caused by these metals should be destroyed by adding sulphurous acid; presence of nickel renders the process useless. L. de K.

Volumetric Estimation of Nickel. By Thomas Moore (*Chem. News*, 1895, **72**, 92—93).—The process is based on the one used by Campbell and Andrews (this vol., ii, 421), but the author gives an important modification: 20—25 grams of pure potassium cyanide is dissolved in a litre of water, and to this is added a solution of about 0·25 gram of silver nitrate. If this solution is added to an ammoniacal solution of nickel containing a little potassium iodide, a precipitate of silver iodide is formed, and this will increase until all the nickel has been converted into double cyanide, when an excess of the cyanide will cause the liquid to clear again.

The value of the cyanide is ascertained, as usual, on a nickel solution of known strength. Cobalt, if present in the sample, will count as nickel. The employment of organic acids or sodium pyrophosphate in case iron or zinc is present dispenses with their tedious separation, which is a matter of considerable importance in the assay of nickel matte or German silver. L. DE K.

The Estimation of Molybdenum. By CARL FRIEDHEIM and HANS EULER (*Ber.*, 1895, **28**, 2061—2067).—Molybdenum sulphide can readily be converted into molybdic anhydride without loss, when it is washed free from sulphuric acid, dried at 100°, and then ignited along with the filter paper, at first in a covered crucible and then exposed to the air. The ignited mass is treated with ammonia, filtered from any unburnt carbon, evaporated to dryness, and carefully heated.

The method proposed by Mauro and Danesi for the volumetric estimation of molybdenum, which depends on the reduction of the anhydride by hydriodic acid, may be conveniently carried out by distilling the molybdate, which is to be analysed, with potassium iodide and hydrochloric acid and collecting the liberated iodine in potassium iodide solution. The amount of iodine set free is then estimated with thiosulphate solution. A. H.

Volumetric Estimation of Molybdic and Vanadic Anhydrides in the same Solution. By CARL FRIEDHEIM and HANS EULER (*Ber.*, 1895, **28**, 2067—2073; compare foregoing abstract).—Holverscheit (*Dissertation*, *Berlin*, 1890) has shown that when vanadic anhydride is distilled with fuming hydrochloric acid and potassium bromide, it is quantitatively reduced to vanadium tetroxide. On the other hand, vanadic anhydride is completely converted into the trioxide when it is distilled with hydrochloric acid, a little phosphoric acid, and potassium iodide.

These reactions, together with the reaction of molybdic anhydride described in the preceding abstract, render it possible to estimate vanadic and molybdic anhydrides volumetrically in the same solution. For this purpose, the mixture is first distilled with fuming hydrochloric acid and potassium bromide, by which the vanadic anhydride is reduced to vanadium tetroxide with liberation of bromine; this is collected in potassium iodide solution, and the liberated iodine estimated by sodium thiosulphate solution. The residue in the retort is then distilled with hydrochloric acid, a little syrupy phosphoric acid, and potassium iodide. In this way the vanadium tetroxide is further reduced to the trioxide, an amount of iodine being liberated which is equal to that set free in the previous reduction of the pentoxide to tetroxide, whilst the molybdic anhydride is converted into the oxide Mo_2O_5.

The reactions are as follows. (1) $V_2O_5 + 2HBr = V_2O_4 + H_2O + Br_2$. (2) (*a*) $V_2O_4 + 2HI = V_2O_3 + H_2O + I_2$; (*b*) $2MoO_3 + 2HI = Mo_2O_5 + H_2O + I_2$.

The amount of iodine corresponding with the molybdic anhydride present is therefore found by subtracting from the total iodine liberated during the second distillation, an amount equal to that liberated during the first.

The authors hope to extend this method to the determination of other oxides. A. H.

Estimation of Uranium in Earths containing Phosphoric and Arsenic Acids. By C. Remigius Fresenius and E. Hintz (*Zeit. anal. Chem.*, 1895, **34**, 437—439).—Separation by the ordinary methods presents many difficulties. The feebly acid (hydrochloric) solution from which silica has been removed is precipitated with an excess of potassium ferrocyanide, and then saturated with sodium chloride. This addition causes the precipitate to settle rapidly, and enables it to be filtered and washed easily. The precipitate is thoroughly washed with sodium chloride solution, and then decomposed in the cold with dilute potash. After partial washing by decantation the hydroxides are rinsed on to a filter with water containing ammonium chloride and ammonia, and washed with the same solution until free from ferrocyanide. The oxides, which are now free from phosphoric and arsenic acids, are dissolved in hydrochloric acid, the solution is nearly neutralised with ammonia, mixed with an excess of ammonium carbonate, and digested for some time in the cold to precipitate the iron. The filtrate is heated to remove the greater part of the ammonium carbonate, acidified with hydrochloric acid, and treated with hydrogen sulphide to remove copper. From the filtrate, the uranium is precipitated by ammonia and weighed either as uranoso-uranic oxide, or, after ignition in hydrogen, as uranous oxide. A test analysis gave a perfectly satisfactory result. M. J. S.

Separation of Bismuth from Lead. By Olav Steen (*Zeit. angw. Chem.*, 1895, 530—535).—The author has investigated 12 published methods for the separation of bismuth from lead, and tabulated the results. Three processes only can be recommended: Rose's process, in which the lead is estimated as sulphate and the bismuth as oxychloride; Lowe's process, in which the bismuth is separated as oxynitrate and the lead as sulphide or sulphate; Jannasch's method, in which the bismuth is volatilised as bismuth bromide by heating the mixed sulphides in a stream of bromine vapour mixed with air. L. de K.

Separation of Gold and Silver from Iron and Steel. By Henry N. Warren (*Chem. News*, 1895, **72**, 100—101).—In order to test some bars of iron of 1-in. circumference for gold and silver, 4 lbs. of the sample was attached to the positive pole of a battery of 3 volts 40 ampères, a carbon negative electrode being used; dilute sulphuric acid was employed by the author as a solvent. The mass having disappeared save a thin wire of iron, this carboniferous residue was dried, intimately mixed with chemically pure litharge, and reduced in the usual way. The silver button was afterwards examined for gold by parting.

Calculating to percentages of the carboniferous residue, Swedish iron yielded 0·8 per cent., Low Moor iron 0·1 per cent., and Dannemora iron 0·064 per cent. of silver; this was found to contain traces of gold. L. DE K.

Gasometric Estimation of Glycerol. By FRIEDRICH GANTTER (*Zeit. anal. Chem.*, 1895, **34**, 421—426).—Glycerol can be very conveniently estimated by the use of the author's gas volumeter (Abstr., 1894, ii, 26) to measure the volume of carbonic anhydride evolved when the glycerol is oxidised by potassium dichromate and sulphuric acid. In the flask are placed 3 grams of solid potassium dichromate and 5—10 c.c. of the glycerol solution containing not more than 0·3 gram of glycerol, and in the pipette 10 c.c. of sulphuric acid consisting of 2 vols. of the concentrated acid diluted with 1 vol. of water. The greater part of the dichromate is now dissolved by gently warming, and the sulphuric acid is then admitted a drop at a time. When all the acid has been run in, and the action slackens, the mixture is heated to boiling and kept in ebullition for 15 minutes. The special laboratory vessel employed for nitric acid estimations, with an empty absorption tube between the flask and the pipette should be used.

Employing this method, the author has studied the behaviour of aqueous and alcoholic solutions of glycerol when evaporated, and finds that no loss of glycerol occurs during the evaporation to dryness on the water-bath, but commences when the residue is heated at 100° after the complete evaporation of the solvent. An estimation of the glycerol in a fat (by saponification with strong soda, decomposition of the soap, filtration from the fatty acid, and assay of the aqueous filtrate) can be completed in 80 minutes. M. J. S.

Detection of Small Quantities of Sugar in Urine. By HERMANN FOCKE (*Chem. Centr.*, 1894, ii, 453; from *Apoth. Zeit.*, **9**, 559).—Ten grams of the sample is boiled with 5 grams of copper sulphate solution (1—9); after cooling, the liquid is filtered and mixed with 2 grams of solution of sodium carbonate (1—9) and, after settling, again filtered. Of the urine thus purified, a few drops are added to a hot Fehling's solution diluted with an equal bulk of water, and the whole is boiled; if sugar is present, a characteristic red precipitate will be obtained. If the amount of sugar is below 0·05 per cent., the whole of the filtrate should be mixed with some more copper solution, excess of alkaline solution of Rochelle salt added, and the mixture boiled. L. DE K.

Testing Urine for Acetone. By C. GULDENSTEEDEN EGELING (*Chem. Centr.*, 1894, ii, 457—448; from *Nederl. Tydschr. Pharm, &c.*, **6**, 217—218).—Diabetic urine is generally tested for acetone by Legal's reaction; addition of sodium nitroprusside, aqueous soda and then acetic acid, which produces a carmine-red colour. According to Salkowski, this test is not decisive, as aldehyde, for instance, also gives the colour. A more trustworthy test is given by Le Nobel, namely, addition of sodium nitroprusside and ammonia, when a splendid violet colour is gradually developed. The reaction is also given by acetoacetic acid, but as this always accompanies acetone and is itself readily split up into acetone and carbonic anhydride, the author thinks that Le Nobel's test is the best. L. DE K.

Estimation of Hydrocyanic Acid. By CARL GLÜCKSMANN (*Chem. Centr.*, 1895, i, 134; from *Pharm. Post.*, 1895, 525—527).—The author recommends the following modification of Denigès' process which is useful when the presence of ammonia is suspected. Fifty c.c. of the sample, cherry-laurel water for instance, is diluted with an equal bulk of distilled water, and, if turbid, cleared by adding alcohol. 0·2 gram of potassium iodide and 5 c.c. of ammonia are added, and the hydrocyanic acid rapidly titrated by running in N/10 silver nitrate solution until the liquid gets turbid. L. DE K.

Estimation of the Volatile Acids in Wines. By E. BURCKER (*Compt. rend.*, 1895, **120**, 1223—1225).—The author has investigated the accuracy of his method of estimating the volatile acids in wine by distilling in a current of steam and titrating the distillate with decinormal sodium hydroxide solution, using phenolphthaleïn as indicator. Experiments were made with solutions of various acids and hydrogen salts usually present in wines, about 10 per cent. of alcohol by volume being added to the solutions. The results show that non-volatile acids, whether present in the free state or as salts, exert no appreciable influence on the acidity of the distillate. The acidity is due mainly to acetic acid, and any of the latter which is present in the form of calcium salt, &c., is completely liberated by adding a small quantity of succinic or tartaric acid or potassium hydrogen tartrate.

The method of distillation in steam gives results comparable with those obtained by determining the total acidity, and the residual acidity after evaporation in a vacuum.

The maximum acidity in French wines is equivalent to 0·70 gram of sulphuric acid per litre, whilst in Algerian and Tunisian wines it may be as high as 1·60 gram. C. H. B.

Estimation of Uric acid and Xanthine Compounds in Urine. By ERNST SALKOWSKI (*Chem. Centr.*, 1894, ii, 456; from *Centr. Med. Wiss.*, 1894, 514—515).—The uric acid is precipitated from 500—1000 c.c. of urine by means of ammoniacal solution of silver nitrate, after the phosphatic matter has been removed by means of magnesium mixture. The precipitate, suspended in water, is decomposed with hydrogen sulphide, and the filtrate evaporated to dryness; the residue is then treated for 24 hours with a little water containing 2—3 per cent. of sulphuric acid, which dissolves the xanthine compounds, and leaves the uric acid as it is practically insoluble. It is not advisable to try and remove any dissolved uric acid by means nitric acid, as this also partly destroys the xanthine compounds, but the latter may be reprecipitated by means of ammoniacal silver nitrate, and estimated from the amount of metallic silver in the precipitate. The author found the quantity to be about 8—10 per cent. of the uric acid. These xanthine substances are not true xanthines, but resemble hypoxanthine. L. DE K.

Estimation in Butter of the Fatty Acids Soluble in Water containing Sulphuric acid. By ALEXANDER ZEGA (*Chem. Zeit.*, 1895, **19**, 504—505).—2—2·5 grams of butter fat is weighed into a 200 c.c. calibrated flask, 2 c.c. of aqueous potash is added, and then 10 c.c. of alcohol, the flask being heated on the top of the water bath until saponification seems complete. The flask is now placed in boiling water for 20 minutes to expel the bulk of the spirit, and the soap is dissolved in 50—70 c.c. of hot water; after cooling, the solution is diluted to the mark, 2 c.c. of sulphuric acid, strong enough to leave an excess of 0·6 c.c. of acid, is added, the mixture well shaken, and filtered. Fifty c.c. of the filtrate is titrated with N/10 soda, using methyl-orange as indicator; another 50 c.c. is then titrated with the aid of phenolphthaleïn. The number of c.c. of soda of the first titration deducted from the second experiment gives the soda representing the soluble fatty acids. One gram of pure butter fat consumes about 5·8 c.c. of N/10 alkali. L. DE K.

Centrifugal Estimation of Fat in Milk. By JOSEF ZEHENTER (*Chem. Centr.*, 1894, ii, 458; *Program Oberrealschule, Innsbruck* 1893–94).—The author has come to the conclusion that the estimation of fat in milk by means of the centrifugal machines and the processes of both Babcock and Gerber leaves nothing to be desired, as regards accuracy. As regards cream, the results are not quite so accurate, but still satisfactory when the sample is weighed out instead of being measured. L. DE K.

Milk Analysis. By ERNST BECKMANN (*Chem. Centr.*, 1895, i, 239; from *Milch Zeit.*, **23**, 702—703).—*Estimation of Fat.*—Twenty-five c.c. (or grams) of the sample is put into a stoppered glass cylinder, diluted with an equal volume of water, and shaken with 2·5—5 c.c. of basic lead acetate; solution of sodium carbonate is then added to promote precipitation. The deposit is collected, and put back into the cylinder, together with some glass bulbs of 3 mm. in diameter; agitation with ether now removes the fat completely without producing an emulsion. The filter is washed with ether, which may then be used to extract the precipitate. The process gives accurate results with all kinds of milk. Sour milk is best precipitated with ammoniacal basic lead acetate.

Freezing Point.—This is dependent on the amount of water, but independent of the amount of fat. Genuine milk has a low, constant, freezing point, $-0·54°$ to $-0·58°$, average $-0·554°$. The experiment is made by placing the sample in a mixture of ice and salt, actively stirring with a delicate thermometer. As soon as the temperature goes down to $-1°$ or $-2°$, there is again a sudden rise, and it then remains very constant for some time. This gives the freezing point, which, in careful hands, will tell the presence of 10 per cent. of water. L. DE K.

Analysis of Cheese. By M. KÜHN (*Chem. Zeit.*, 1895, **19**, 554; 601—602; 648—649).—The chief mode of adulterating cheese is by adding margarine to the skim-milk from which the cheese is prepared.

In testing such cheese, it is important to extract the whole of the fat before submitting it to analysis. The mere taking of its specific gravity is nowadays not sufficient to form an opinion, but the extracted fat should be tested by the Reichert-Wollny or, better still, by the Köttstorfer process. The refractometer may also give useful indications, and has the advantage of requiring but little fat. When using it, the fat should be perfectly free from ether. Fats which are somewhat decomposed have a tendency to give too high a refraction.

L. DE K.

Estimation of Fat in Animal Organs. By C. DORMEYER (*Pflüger's Archiv*, 1895, **61**, 341—342).—For the extraction of fat from animal organs, Soxhlet's apparatus was found to give imperfect results, for, after 100 hours' extraction with ether, in spite of the finely divided state of the tissue, fat still remained undissolved. It is recommended that the tissue should be subjected to artificial gastric digestion before extraction; the powdered flesh was then found to yield an additional 0·75 per cent. of fat. W. D. H.

Detection of Earth-nut Oil. By HANS KREIS (*Chem. Zeit.*, **19**, 1895, 451—452).—The author recommends the following modification of Rénard's process:—The fatty acids from 20 grams of the sample are dissolved in 300 c.c. of ether, and slowly mixed with 150 c.c. of alcohol containing 15 grams of lead acetate; the lead oleate remains almost entirely in solution, and the deposit consists of the lead salts of the solid fatty acids. After washing these with ether, they are boiled with 250 c.c. of 5 per cent. hydrochloric acid, until the fatty acids have quite melted, washed a few times with boiling water, to remove the lead chloride, and, after cooling, the cake is dried between blotting paper, and dissolved in 100 c.c. of 90 per cent. alcohol with the aid of a gentle heat. On cooling, any arachidic acid will slowly crystallise out, and may afterwards be recognized by its melting point (74°). Its weight multiplied by 110 gives the approximate percentage of arechis oil in the sample. L. DE K.

Essential Oils. By SCHIMMEL and Co. (*Zeit. anal. Chem.*, 1895, **34**, 480—483).—In consequence of partial oxidation, the essential oils from dried plants differ somewhat in specific gravity and optical rotation from those obtained from fresh plants. The latter are also generally paler in colour, purer in odour, and freer from resin than the former. The constituents of bay oil (*Oleum myricæ*) are eugenol, "myrcon" ($C_{10}H_{16}$? myrtene), chavicol ($C_9H_{10}O$), methyleugenol, methylchavicol, phellandrene, and geranaldehyde ($C_{10}H_{16}O$). The sp. gr. varies from 0·965 to 0·985. The phenols, which amount to 60—65 per cent., can be approximately estimated by shaking 10 c.c. of the oil with strong potash in a flask with narrow graduated neck, and driving the undissolved (non-phenolic) residue into the neck by gradual addition of water. Adulteration with turpentine oil can be detected by examining for pinene. From 10 c.c. of the oil, 1 c.c. is slowly distilled off and mixed with 1 c.c. of amylic nitrate and 2 c.c. of glacial acetic acid. Then, whilst shaking and keeping cold, a mixture of equal parts of hydrochloric acid and glacial acetic acid is added as long as a blue coloration is produced. In presence of pinene, a white precipitate of pinene nitrosochloride is formed.

The sp. gr. of citron oil at 10° is 0·8625, and the rotation $[\alpha]_D = \frac{100\,\alpha}{l\,c} = +\,74°\,10'$. For a rise of 1° up to 20°, the sp. gr. diminishes by 0·00082, and the rotation (in a 100 mm. tube) by 0° 9′. From 20—30°, the changes are 0·00068 and 0° 7·8′ per degree. For orange oil, the values at 10° are: 0·8550 and +116° 36′, and up to 20° the diminution per degree 0·00081 and 0° 14·5′; and, from 20° to 30°, 0·00073 and 0° 13·2′.

To detect geraniol in essential oils, when the proportion exceeds 25 per cent., the dry oil is intimately mixed with an equal weight of dry powdered calcium chloride, and the mixture kept in a desiccator at −4° or −5° for 12—16 hours. The soft mass is rubbed up with dry benzene, ether, or light petroleum, and the liquid portion removed by a suction filter. The calcium chloride compound of geraniol is then treated with water, and the oil separated, washed, and distilled, when geraniol passes over at 228—230°. M. J. S.

Estimation of Urea in Urine. By A. KOSSEL and H. SCHMIED (*Chem. Centr.*, 1895, i, 236—237; from *Du Bois-Raymond Arch.*, 1894, 552—553).—Ten c.c. of urine mixed with a little barium carbonate is heated in a sealed tube at 180° for an hour. The contents are transferred to a distilling flask, barium hydroxide is added, and the distillate collected in an absorption apparatus containing N/10 acid. Experiments with solutions of urea of known strength proved the accuracy of the authors' process, which is not influenced by the presence of uric or hippuric acid. L. DE K.

Estimation of Nicotine and Ammonia in Tobacco. By VIKTOR VEDRÖDI (*Zeit. anal. Chem.*, 1895, **34**, 413—420).—The author now recognises that the error in Kissling's method which he attributed to the passing over of ammonia along with the nicotine (Abstr., 1893, ii, 504) is due to soda carried over by the steam, and therefore recommends that the addition of the 50 c.c. of 4 per cent. soda solution to the light petroleum (not ethylic ether as Kissling appears to have used) extract (see Abstr., 1882, 1005) should be omitted, since the whole of the nicotine in the petroleum extract is already in the free state, and that the distillation should be carried on without the use of a steam current, except that when the contents of the retort have been evaporated almost to dryness a current of steam should be admitted to sweep into the receiver the last traces of nicotine. Before beginning the distillation, 100 c.c. of water is added to the petroleum extract. About one-fifth of the nicotine comes over with the petroleum, the remainder with the aqueous distillate. To titrate the petroleum distillate, 50 c.c. of water is added, then litmus, and of the standard acid a few drops at a time until the water below the petroleum remains coloured violet even after shaking vigorously.

Experiments made with tobacco powder, which had been first freed from nicotine and ammonia by making alkaline with alcoholic soda, extracting with light petroleum and drying, and had then been mixed with known amounts of nicotine, with or without ammonium chloride, gave fairly correct yields, the greatest error amounting to a loss of 6 per cent. of the nicotine taken, and the estimation being unaffected by the presence of the ammonia. The distillation of the tobacco itself with soda (10 c.c. of the 6 per cent. alcoholic soda, and 100 c.c. of water, to 20 grams of tobacco) gives both the nicotine and ammonia, so that the ammonia is known from the difference between the two titrations.

The paper contains some unexplained arithmetical discrepancies.

M. J. S.

Estimation of Theobromine in Cocoa-nibs and in Cocoa. By ALBERT HILGER and A. EMINGER (*Chem. Centr.*, 1894, ii, 462; from *Forschungsber. Lebensm.*, **1**, 292).—Ten grams of the powdered sample is digested with 150 grams of light petroleum for 12 hours, the insoluble portion is dried, and 5 grams of it is boiled with water containing 3 per cent. of sulphuric acid for fully half an hour, using a reflux condenser. The mixture is then neutralised with barium carbonate, some sand added, and the whole evaporated to dryness. The mass is extracted with 100 grams of chloroform, and the residue left on evaporating the latter, is extracted with carbon tetrachloride to remove impurities such as fat and caffeïne. The theobromine is further purified by dissolving, in water, filtering, and evaporating the solution.

L. DE K.

Detection and Estimation of Strychnine in Corpses. By ALLERTON S. CUSHMAN (*Chem. Centr.*, 1894, ii, 461; from *Trans. Acad. Sci., St. Louis*, **6**, 17).—In cases of strychnine poisoning, the alkaloïd should be quantitatively estimated, but as the author has found that a good deal of it is destroyed by the usual process of heating the impure chloroform extract with strong sulphuric acid to destroy fatty and colouring matters, he prefers to treat the alcoholic extract with water and a few drops of acetic acid, and then to repeatedly extract the aqueous solution with ethylic acetate. The purified liquid is then rendered alkaline with sodium carbonate, and again agitated with ethylic acetate, which now dissolves the strychnine. The residue left on evaporating the solvent is dissolved in water and a little acetic acid, and purified by agitating with a mixture of ether and chloroform. The liquid is then rendered alkaline with ammonia and again agitated with the said mixture; the alkaloïd will then be left in a very pure state on evaporating the mixture. In two experiments, 86·2—87·8 per cent. of added strychnine was respectively recovered.

L. DE K.

Detection and Estimation of Albumin in Urine. By E. RIEGLER (*Zeit. anal. Chem.*, 1895, **34**, 485—486; from *Wiener Klin. Wochenschs.*, 1894, No. 52).—To 4—5 c.c. of the urine there is added 10 drops of a 10 per cent. solution of calcium β-naphthol-α-sulphonate (asaprol), previously mixed with one-tenth of its volume of concentrated hydrochloric acid. Albumin, albumoses, and peptones, when amounting to only 0·01 per cent., are precipitated. On warming, the albumoses and peptones redissolve, the albumin remaining insoluble. If filtered hot, the albumose and peptone precipitate reappears on cooling the filtrate. M. J. S.

Estimation of the Nitrogenous Constituents of Meat Extract and Commercial Peptones. By ALBERT STUTZER (*Zeit. anal. Chem.*, 1895, **34**, 372—380).—This article consists chiefly of modifications of the methods previously described (Abstr., 1893, 146). Contrary to the statement then made, gelatin-peptone is found to be insoluble in absolute alcohol. The viscosimetric method of estimating gelatin being inconvenient when only a small quantity of substance is available, the alcohol method of Kemmerich and Denaeyer (see Abstr., 1894, ii, 150) has been tried, and found to return 95—98 per cent. of the gelatin taken. It is to be noted that meat extracts contain ammonia, but in what state of combination is uncertain. It can be determined by distilling with barium carbonate.

The course of the analysis is as follows:—Unchanged muscular fibres should be sought for with the microscope, and, if found, a weighed quantity of the substance is extracted with cold water, and the nitrogen determined in the insoluble matter, the filtrate being acidified with acetic acid and boiled for estimation of albumin. For the estimation of the water, the substance is first weighed into a tinfoil capsule and there dissolved in a little hot water; a weighed quantity of ignited, long-fibred asbestos, sufficient to absorb all the liquid, is then added, and the whole dried in the water bath. The residue serves for the gelatin estimation; for this purpose, the capsule and contents are cut up and washed four times with absolute alcohol, extracted with water, to which 1/10 of its volume of alcohol has been added, at a temperature not exceeding 5°, and finally washed with the same until the washings are colourless. The filter and contents are then boiled with water, and in the solution obtained the gelatin is estimated (from a nitrogen determination). The precipitations with ammonium sulphate are carried on as in the former paper, but instead of estimating the adhering ammonium sulphate by a sulphuric acid determination, the ammonia is expelled by evaporating the solution with excess of barium carbonate. M. J. S.

Analysis of Meat Extracts and Peptones. By ALBERT STUTZER (*Zeit. angw. Chem.*, 1895, 529).—The author calls attention to the fact that most of the analyses of these articles have been made by methods, the scientific value of which is rather doubtful.

An analysis is given of a Liebig-Kemmerich's meat peptone, showing the amount of the various nitrogenous substances and mineral salts present in it. The analysis has been made by the author's method (preceding abstract). L. DE K.

Analysis of Gastric Juice. By J. WINTER (*Bull. Soc. Chim.*, 1895 [3], **13**, 433—441).—The fixed chlorides are estimated in the ash obtained on heating the residue from the evaporation of the gastric juice (5 c.c.) over a naked flame for five minutes; the result is constant for the same sample. The slight loss of chlorine during the incineration is probably due to a cause other than mere volatilisation, for when the ash is taken to dryness again with hydrochloric acid, the resulting gain is found to vary with the stage of digestion at which the sample was taken.

In determining the free and organic hydrogen chloride, several portions of the juice are evaporated and dried respectively at 100°, 110°, 120°, and 135°, and a further portion is incinerated; the chlorine is then estimated in the original liquid and in each dried portion, and the loss of hydrogen chloride at each stage of drying calculated; the sum of the losses is always practically equal to the acidity of the juice.

The author designates as free hydrogen chloride that portion which is volatilised at 100°, and, as the organic acid, that portion which remains at that temperature; in both forms, it probably exists in complex, unstable, albuminoïd combination. JN. W

Estimation of Dry Matter in Peat. By H. PUCHNER (*Landw. Versuchs-Stat.*, 1895, **46**, 221—231).—A number of peaty soils were heated at 105° for 14 days, being weighed every 24 hours. The soils first lost in weight continuously; then the loss was very slow, the soils sometimes gaining slightly for a day or two owing to oxidation. It was quite impossible to obtain a constant weight. It is probable that oxygen is taken up by the organic matter, and is then partly eliminated as water; there was also a loss of nitrogen. There was more increase in weight when the soils were cooled over sulphuric acid than when calcium chloride was employed. When the soils were dried in a vacuum over sulphuric acid and over phosphoric anhydride, constant weights were obtained after a good many days; but the two sets of results did not always agree. The only trustworthy method seems to be keeping the soil in a vacuum over phosphoric anhydride.

N. H. J. M.

INDEX OF AUTHORS' NAMES.

ABSTRACTS. 1895. Parts I & II.

And also to Transactions, 1895 (marked TRANS.); and to such papers as appeared in the Proceedings during the Session 1894—1895 (Nos. 142 to 154; Nov., 1894, to July, 1895), but not in Transactions (marked PROC.).

A.

Abbot, *Charles G.* See *A. A.* **Noyes.**

Abegg, *Richard*, freezing points of concentrated solutions, ii, 71.

Abegg, *Richard.* See also *W.* **Nernst.**

Abel, *John J.*, ethylic sulphide in dog's urine, ii, 81.

Adrian, preparation of ethylic bromide, i, 485.

—— impurities in ethylic ether, i, 488.

Ahrens, *Cæsar.* See *M.* **Dennstedt.**

Ahrens, *Felix B.*, coal-tar bases, i, 390.

Aitken, *Andrew P.*, estimation of woody fibre in fodders, ii 189.

Albert, *Robert*, phenolphthaleïnanhydrideanilide and galleïnanilide, i, 54.

Albrecht, *Karl*, diphenylmethane colouring matters, i, 145.

Alexander, *Walter*, phthalyl compounds of amidoacetal, i, 90.

Alexéeff, *Wladimir*, mineral wax from Kaluga, ii, 20.

Allein and *Fernand* **Gaud**, decomposition products of glucose. i, 123.

—— —— modification of the copper test for glucose, ii, 92.

Altschul, *Michael*, and *B. v.* **Schneider**, freezing points of some organic liquids, ii. 206.

Altschul, *Michael.* See also *R.* **Pictet.**

Alvisi, *Ugo*, complex inorganic acids, ii, 18.

—— relation between the molecular weight and density of liquid and solid substances. ii. 307.

Amaral, *Abelardo, P. do.* See *P. A.* **Guye.**

Ammelburg, *Alfred.* See *A.* **Claus.**

Amthor, *Karl.* estimation of cane sugar in beer wort, ii, 93.

Anderlini, *Francesco* and *R.* **Salvadori**, comparative investigation of the methods of fractional distillation, ii, 304.

Andouard, *Ambroise*, phosphate from Grand-Connétable, ii, 242.

André, *Gustave.* See *M.* **Berthelot.**

Andreasch, *Rudolf*, dimethylvioluric acid and dimethylnitrobarbituric acid, i, 336.

Andreocci, *Americo.* See *S.* **Cannizzaro.**

Andrews, *Ernest R.* See *R.* **Meldola.**

Andrews, *Launcelot W.*, solutions of ferric thiocyanate, i, 77.

—— the assumption of a special "nascent" state, ii, 43.

Andrews, *Launcelot W.*, and *Carl* **Ende**, physical properties of solutions of lithium chloride in amylic alcohol, ii, 383.

Andrews, *W. H.* See *E. D.* **Campbell.**

Andrlik, *K.*, Beet pectin, i, 556.

Angeli, *Angelo*, compounds containing the group $C_nH_2O_2$, i, 47.

—— action of nitrous acid on amidocamphor, i, 61.

—— action of nitrous acid on amidouracil and amidoacetone, i, 328.

—— action of nitrous acid on amidocamphor, i, 382.

—— conversion of camphor into an isomeric unsaturated compound, i, 426.

—— a new explosive mixture, ii, 9.

Angeli, *Angelo*, and *Giovanni* **Malagnini**, configuration of certain glyoximes, i, 36.

Angeli, *Angelo*, and *P.* **Mole**, diisosafrole and cubebin, i, 24.

Angeli, *Angelo*, and *E.* **Rimini**, bromo-derivatives of the camphor series, i, 382.

Angeli, *Angelo*, and *E.* **Rimini**, action of nitrous acid on oximes of the camphor (camphane) series, i, 426.

Anschütz, *Richard*, constitution of succinanil, i, 177.

—— aromatic glyoxaline compounds, i, 304.

Anschütz, *Richard*, and *Charles* **Beavis**, action of phosphorus pentachloride on succinanil, i, 176.

Anschütz, *Richard*, and *H.* **Beckerhoff**, identity of Liebmann's isoamylphenol with tertiary amylphenol, i, 273.

Anschütz, *Richard*, and *W.* **Montfort**, synthesis of α-phenyl-β-benzoylpropionic acid, i, 179.

Anschütz, *Richard*, and *Hermann* **Müller**, action of monosubstituted derivatives of carbamide and thiocarbamide on benzoïn, i, 305.

Anschütz, *Richard*, and *Hermann* **Pauly**, isomeric osazones of ethylic dioxysuccinate, i, 172.

Anschütz, *Richard*, and *Wilhelm* **Posth**, ethereal salts of catechol with phosphorous and sulphurous acids, i, 23.

Anschütz, *Richard*, and *Hans* **Reitter**, optical rotation of ethereal salts of malic acid, ii, 251.

Anschütz, *Richard*, and *K.* **Schwickerath**, constitution of products obtained from benzoïn by the action of thiocarbamide or ammonium thiocyanate and carbamide, i, 304.

Anschütz, *Richard*, and *K.* **Stiepel**, diamido ethers, i, 170.

Antusch, *A. C.* See *A. F.* **Holleman.**

Apitsch, *H.* See *O.* **Fischer.**

Appleyard, *James R.*, and *James* **Walker**, ethereal salts of ethanetetracarboxylic acid, Trans., 768.

Araki, *Trasaburo*, carbohydrates prepared from formaldehyde, i, 444.

—— chitosan, i, 444.

Araki, *Trasaburo*. See also *F.* **Hoppe-Seyler.**

Archbutt, *Leonard*, analysis of sodium peroxide, ii, 185.

—— Gladding's process for estimating resin in soap, ii, 190.

Archdeacon, *W. H.*, and *Julius B.* **Cohen**, a new method of preparing cyanuric acid, Proc., **1895**, 148.

Arctowski, *Henryk*, volatility of mercuric chloride, ii, 15.

—— double decomposition between gaseous compounds, ii, 225.

—— action of heat on carbon bisulphide, ii, 312.

Arctowski, *Henryk*, hydrolysis of aqueous solutions of mercuric chloride, ii, 393.

—— volatility of chromic anhydride, ii, 396.

—— solubility of carbon compounds in carbon bisulphide at low temperatures, ii, 489.

Ariff, *Mehmed*, αβ-dibromoisovaleric acid, i, 16.

Armstrong, *Henry E.*, presidential address, Trans., 1105.

Armstrong, *Henry E.*, and *William P.* **Wynne**, studies on the constitution of the tri-derivatives of naphthalene. No. 10. The dichloro-α-naphthol and trichloronaphthalenes from 3 : 4-dichlorophenyl - 1 - isocrotonic acid, Proc., **1895**, 78.

—— —— studies on the constitution of the tri-derivatives of naphthalene. No. 11. The trichloronaphthalene derivable from Cleve's 1 : 2 : 2′ : α-nitrochloronaphthalenesulphonic chloride, Proc., **1895**, 79.

—— —— studies on the constitution of the tri-derivatives of naphthalene. No. 12. The trichloronaphthalene derivable from Alen's α-nitronaphthalene-2 : 2′-disulphonic chloride, Proc., **1895**, 81.

—— —— studies on the constitution of the tri-derivatives of naphthalene. No. 13. The α-naphthylamine-2 : 2′-disulphonic acid of Freund's German patent 27346, Proc., **1895**, 82.

—— —— the non-existence of a trichloronaphthalene melting at 75·5°. The formation of chloro-derivatives from sulphonic chlorides, Proc., **1895**, 83.

—— —— studies on the constitution of the tri-derivatives of naphthalene. No. 14. The 14 isomeric trichloronaphthalenes, Proc., **1895**, 84.

Arnstein, *Hugo*. See *F.* **Feist.**

Arth, *Georges*, action of water on coal, ii, 264.

Arthus, *Maurice*, fibrinogen and fibrin, ii, 234.

Arzruni, *Andreas*, nephrite from Kuen-lun, ii, 510.

Arzruni, *Andreas*, and *Emil* **Schütz**, crystallised products formed in the Deacon process, ii, 75.

Arzruni, *Andreas*, and *Konstantin* **Thaddéeff**, celestite from Giershagen, Westphalia, ii, 505.

Asbrand, *Ernst*. See *M.* **Freund.**

Aschan, *Ossian*, preparation of bromocamphoric anhydride and of lauronolic acid, i, 154.

Aschan, *Ossian*, camphoronic acid and its optical isomerides, i, 188.

—— camphoronic acid: a correction, i, 242.

—— camphoric dianilide, i, 296.

Aschan, *Ossian*, and *Edvard* **Hjelt**, Finland turpentine, i, 545.

Ashby, *Alfred*, detection of methylated spirits in tinctures, &c., ii, 91.

Aslanoglou, *P. L.*, estimation of carbonates and caustic alkalis in mixtures, ii, 63.

Assfahl, *E.*, nutrition of green plants by glycerol, ii, 126.

Aston, *Emily*. See *W.* **Ramsay** and *J.* **Walker**.

Astre, *Charles*. See *J.* **Ville**.

Athanasescu, *Nicoles*, basic nitrates, ii, 315.

Atterberg, *Albert*, composition of oat plants, ii, 365.

Aubin, *Émile*, muffle furnace, ii, 260.

Auriol (*G. A.*) *Henry*. See *D.* **Monnier**.

Autenrieth, *Wilhelm*, action of phosphorus pentachloride on aromatic ethers, i, 511.

—— a new indicator, Luteol, i, 572.

Auwers, *Karl*, trimethylsuccinic acid and the symmetrical dimethylglutaric acids, i, 209, 505.

—— condensation of ethylic malonate with acetone, i, 410.

—— cryoscopic molecular weight determinations, ii, 41.

—— separation and identification of alkylated succinic and glutaric acids, i, 504.

Auwers, *Karl*, and *Titus V.* **Bredt**, butanetetracarboxylic acids, i, 335.

Auwers, *Karl*, and *K.* **Haymann**, interaction of sodium derivatives of phenol and ethylic mono- and dichloracetates, i, 44.

Auwers, *Karl*, and *A.* **Oswald**, sources of trimethylsuccinic acid, i, 505.

Auwers, *Karl*, *A.* **Oswald**, and *Jocelyn F.* **Thorpe**, anilic acids and anils of alkylated succinic and glutaric acids, i, 504.

Auwers, *Karl*, and *Jocelyn F.* **Thorpe**, symmetrical $\alpha\alpha$-dimethylglutaric acids, i, 505.

Aweng, *E.* See *A.* **Tschirch**.

B.

Bach, *A*, alteration of phenol by the action of light and the formation of hydrogen peroxide, i, 340.

Bach, *A.*, hydrogen peroxide in green plants, ii, 26.

—— detection of hydrogen peroxide in green plants, ii, 239.

Bachman, *Irving A.*, improved methods of water analysis, ii, 295.

Bachrach, *Gregor*. See *M.* **Freund**.

Baeyer, *Adolf v.*, orientation in the terpene series, i, 152, 379, 549.

—— constitution of carone, i, 549.

Baeyer, *Adolf v.*, and *Ernst* **Wirth**, metadichlor- and metadibrom-indigo, i, 288.

Bagard, *Henri*, thermoelectric phenomena between two electrolytes, ii, 152.

Baisch, *Karl*, carbohydrates of normal urine, ii, 82.

Baker, *Charles F.* See *R.* **Fittig**.

Baker, *Julian L.* See *A. R.* **Ling**.

Bakunin, *Marussia*, phenylnitrocinnamic acids and their stereoisomerides, i, 531.

Balbiano, *Luigi*, a platinic compound of glyoxaline, i, 72.

—— products of oxidation of camphoric acid, i, 552.

Balcom, *Miss L. L.* See *W. R.* **Orndorff**.

Baldracco, *Giacento*. See *M.* **Fileti**.

Balentine, *W.*, foraging power of some agricultural plants for phosphoric acid, ii, 126.

Baly, *Edward C. C.*, possible explanation of the two-fold spectra of oxygen and nitrogen, ii, 469.

Baly, *Edward C. C.*, and *John C.* **Chorley**, action of nitric acid on lignocelluloses, i, 323.

Baly, *Edward C. C.*, and *William* **Ramsay**, pressure, volume, and temperature relations of rarefied gases, ii, 38.

Bamber, *Henry K.*, analysis of steel, ii, 420.

Bamberger, *Eugen*, stereoisomeric potassium benzenediazosulphonates, i, 25.

—— paranitrodiazobenzene methyl ether, i, 134.

—— alkylic diazo-salts, i, 215.

—— reduction of aromatic nitro-compounds, i, 217.

—— nitration of organic bases, i, 273.

—— theory of diazo-compounds, i, 274.

—— explosiveness of 1 : 4-nitrodiazobenzene nitrate, i, 275.

—— conversion of isodoazohydroxides into derivatives of diphenyl, i, 289.

—— diazo-compounds, i, 350.

Bamberger, *Eugen*, isomerism in the diazo-series, i, 351.
—— constitution of isodiazo-hydrates, i, 459.
—— diazo-haloïd compounds, i, 516.
Bamberger, *Eugen*, and *Frederick D.* **Chattaway,** picene, i, 292
Bamberger, *Eugen*, and *Carl* **Goldschmidt,** anticinnamaldoxime, i, 138.
Bamberger, *Eugen*, and *Alfred* **Kirpal,** nitration of aliphatic bases, i, 261.
Bamberger, *Eugen*, and *Max* **Kitschelt,** synthesis of quinoline and scatole, i, 155.
Bamberger, *Eugen*, and *Franz* **Meimberg,** azo colouring matters, i, 618.
Bamberger, *Eugen*, and *Edm.* **Renauld,** new synthesis of diazomethane, i, 494.
Bamberger, *Max*, natural resins, i, 109.
Bancroft, *Wilder D.*, ternary mixtures, ii, 157.
Band, *Georg*, action of aniline on ethylic 6-ethoxycoumalin-3 : 5-dicarboxylate, i, 560.
Bandrowski, *Ernst*, emission of light during crystallisation, ii, 66, 429.
Banzhaf, *E.* See *E.* **Besthohn.**
Barbéra, *A. G.*, new mercury ureometer, ii, 138.
Barbier, *Henri.* See *A.* **Pictet.**
Barbier, *Philippe*, linalol and licareol, i, 77.
Barbier, *Philippe*, and *Louis* **Bouveault,** oil of pelargonium from Reunion, i, 4.
—— —— constitution of rhodinol from oil of pelargonium, i, 78.
—— —— condensation of aldehydes and ketones, i, 643.
—— —— condensation of unsaturated aldehydes with acetone, i, 643.
Barillot, *Ernest*, detection of colchicine, ii, 300.
—— new fractionating column, ii, 303.
—— estimation of arsenic in organic matter, ii, 329.
Barnett, *Robert E.*, note on the formation of platinic pyrophosphate, TRANS., 513.
Barnstein, *F.* See *A.* **Köhler.**
Barral, *Étienne*, action of phosphorus pentachloride on tetrachloroquinone, i, 24.
—— *α*-hexachlorophenol, i, 272.
—— formation of tetrachloroquinone from hexachlorophenol, i, 343.
—— action of acid chlorides on *α*-hexachlorophenol in presence of aluminium chloride, i, 593.
Barral, *Étienne*, action of aluminium chloride on *α*-hexachlorophenol, i, 594.
—— hexachlorobenzene paradichloride, i, 652.
—— constitution of *α*-hexachlorophenol and of quinol, i, 655.
Barthe, *Léonce*, estimation of salicylic acid and salicylates, ii. 297.
—— volumetric estimation of zinc, ii. 371.
Bartlett, *Edwin J.*, and *Walter* **Merrill,** cupric hydride, ii, 268.
Bartoli, *Adolfo*, dependency of the electrical conductivity of organic salts on the temperature, ii. 4.
—— electrical conductivity near the critical temperature, ii, 377.
Bartoli, *Adolfo*, and *Enrico* **Stracciati,** change in the specific heat of water between 0° and 32°, ii, 5.
—— —— specific heat of water at constant volume, ii, 6.
—— —— correction for thermochemical measurements, ii, 254.
Bartolotti, *Pietro*, action of potassium permanganate, and of hydriodic acid and red phosphorus on rottlerin, i, 429.
Basset, *Henry*, anthracene testing, ii, 332.
Battandier, *J. A.*, reations of chelidonine with phenols, ii, 336.
—— alkaloïds of *Fumariacæ* and *Papareraceæ*, i, 689.
Bau, *A.*, melitriose (raffinose) and its estimation, ii, 425.
Baubigny, *Henri*, antimony vermilion, ii, 114,
—— analytical characters of a mixture of salts of barium, strontium and calcium, ii, 461.
Bauer, *B. W.*, levulose from dried peel of *Citrus aurantium Chinensis*, ii, 129.
Bauer, *Gustav*, specific gravity of saturated vapours, ii. 342.
Baumann, *Eugen*, combination of sulphur in albumin, i, 255.
—— sulphur derivatives of albumins and their interrelation i, 691.
Baumann, *Eugen*, and *Emil* **Fromm,** thiophen-derivatives, i, 337.
—— —— thio-derivatives of ketones, i, 362.
—— —— action of ammonium sulphide on acetophenone, i, 363.
Baumann, *Eugen*, and *P.* **Schmitz,** pariodophenylmercapturic acid, i, 605.
Baumann, *Georg*, dimethylglyoxaldine and methylethylglyoxaldine : resolu-

tion of propylenediamine into its optical components, i, 481.
Baumhauer, *Heinrich*, dufrenoysite from the Binnenthal, ii. 171.
Bayer, *R. S.*, new element from red bauxite, ii, 313.
Bayrac, *Pierre H.*, ethylquinone, i, 412.
—— preparation of paraquinones from indophenols, i, 416.
—— indophenols, i, 416.
—— estimation of total nitrogen in urine, ii, 327.
Bazlen, *Max*. See *H.* **Kiliani.**
Beach, *T. E.* See *T.* **Evans.**
Beadle, *Clayton*, wax found in the treatment of cotton and linen fibre in the manufacture of paper, i, 409.
Beadle, *Clayton*. See also *C. F.* **Cross.**
Beavis, *Charles*. See *R.* **Anschütz.**
Becker, *Arthur*. See *R.* **Sachsse.**
Becker, *Ernst*, and *Emilio* **Parlato**, acetonuria, ii, 407.
Beckerhoff, *H.* See **R. Anschütz.**
Beckh, *Walter*. See *W.* **Wislicenus.**
Beckmann, *Ernst O.*, determination of molecular weights, ii, 154.
—— estimation of gelatin and albumin in presence of peptone, ii, 375.
—— milk analysis, ii, 539
Beckmann, *Ernst O.*, and *August* **Stock**, determination of molecular weights, ii, 382.
Bedford, *Charles S.*, and *Arthur G.* **Perkin**, some derivatives of maclurin, Trans., 933.
Bedson, *P. Phillips*, and *Saville* **Shaw**, on the occurrence of argon in the gases enclosed in rock salt, Proc., 1895, 143
Béhal, *Auguste*, campholenes and the constitution of camphor, i, 240.
—— campholenic acid and campholenamide, i, 241, 552.
—— campholenic derivatives, i, 623.
Behrend, *Otto*, constitutional relations of ricinoleic and oleic acids, i, 647.
Behrend, *Robert*, solubility of double compounds, ii, 71.
—— electrometric analysis, ii, 134.
Behrend, *Robert*, and *Heinrich* **Tryller**, oxidation of aliphatic aldehydes and ketones by nitric acid, i, 201.
Behrens, *J.*, the tobacco plant, ii, 524.
Békétoff, *Nicolai N.*, haloïd salts of cæsium, ii, 264.
—— action of hydrogen on cæsium oxide, ii, 265.
Békétoff, *Nicolai N.* and **Scherbatscheff**, new method of preparing alkali metals, ii, 389.
Belart, *Hans*. See *F.* **Feist.**
Belgardt, *K.* See *v.* **Norden.**
Belairs, *N. E.* See *W. R. E.* **Hodgkinson.**
Bénazet, *P.*, estimation of phosphorus in iron, ii, 328.
Bender, *Fritz*, derivatives of paradimethylamidobenzaldehyde, i, 221.
—— action of alkalis on paranitrotoluenesulphonic acid, i, 287.
Benedikt, *Rudolph*, estimation of chlorine in wool grease, ii, 326.
Benedikt, *Rudolph*, and *Heinrich* **Zikes**, estimation of small quantities of chlorine in fats, ii, 85.
Bentley, *W. H.*, $\beta\beta$-methylethylpropionic acid, $CHMeEt{\cdot}CH_2{\cdot}COOH$, Trans., 264.
Bentley, *W. H.* See also *M. W.* **Burrows.**
Berg, *Armand*, reaction of hydroxycarboxylic acids, ii, 297.
Bergeat, *Alfred*, genetic relations of rutile, ilmenite, and sphene, ii, 400.
Berger, *Richard*, estimation of nitric acid, ii, 528.
Berghoff, *Victor*, indices of refraction of solutions of sulphur and phosphorus in carbon bisulphide, ii, 97.
Berkeley, *the Earl of*, determination of the specific gravity of solids, ii, 485.
Berlemont, safety valve for filter pumps, ii, 346.
—— thermostat, ii, 378.
Bernhard, *Adolph*, introduction of acid radicles into ethylic benzoylacetate, i, 93.
Berthelot, *Marcellin*, argon in combination, i, 412.
—— principle of maximum work and entropy, ii, 42.
—— condensation of electrolytic gas by porous substances, especially metals of the platinum group, ii, 150.
—— limits of electrolysis, ii, 151.
—— spectra of argon and the Aurora Borealis, ii, 337.
—— argon and its fluorescence spectrum, ii, 337.
—— relationship between the latent heats of vaporisation and fusion of substances belonging to the same family, ii, 339.
—— relations between the multiple proportions of chemical compounds and their heats of formation, ii, 340.
—— thermochemical researches on substitution in mineral chemistry, ii, 341.
—— fluorescence of argon and its combination with the elements of benzene, ii, 469.

Berthelot, *Marcellin*, heat of dissolution and neutralisation of campholenic acids, i, 484.
—— combination of nitrogen with carbon and sulphur, ii,495.
—— compound of argon, ii. 498.
Berthelot, *Marcellin*, and *Gustave* **André**, vegetable principles that decompose with liberation of carbonic anhydride, ii. 124.
—— —— alumina in plants, ii, 284.
Berthelot, *Marcellin*, and *Camille* **Matignon**, barium nitride, ii, 255.
Berthelot, *Marcellin*, and *Paul* **Rivals**, thermochemical relations between aldehydes, alcohols, and acids, i, 435.
—— —— campholenic lactones, ii, 484.
Bertoni, *Giacomo*, furfurylic and other nitriles, i, 22.
Bertram, *Julius*, and *Rudolf* **Kürsten**, orthocoumaraldehyde methyl ether from oil of cassia, i, 279.
Bertram, *Julius*, and *Heinrich* **Walbaum**, oil of mignonette, root, i, 218.
Bertrand, *Gabriel*, sap of the lac tree, i, 385.
—— laccase, an oxidising diastase, i, 386.
Bertrand, *Gabriel*, and *Alfred* **Mallèvre**, pectase and the pectic fermentation, i, 312.
Besson (*J.*) *Adolphe*, carbonyl bromide and chlorobromide, i, 317.
—— properties of ozone, and of oxygen in presence of sunlight, ii, 493.
Best, *Otto*, hydroxyterpenylic acid, i, 153.
Besthorn, *Emil*, *E.* **Banzhaf**, and *G* **Jaeglé**, 4′-orthohydroxyphenylquinoline and 4′-metahydroxyphenylquinoline, i, 113.
Bethe, *Albrecht*, the silvery substance in the skin of *Alburnus lucidus*, ii. 279.
Bevan, *Edward J.*, loss of total solids in milk on keeping, ii. 95.
Bevan, *Edward J.* See also *C. F.* **Cross**.
Bial, *F.* See *A.* **Werner**.
Biehringer, *Joachim*, pyronines, i. 146.
Biernacki, *E.*, the blood in anæmia, ii. 24.
Biginelli, *Pietro*, coumarincarboxylate and a new synthesis of coumarin, i, 419.
Bigot, *C.*, a gas furnace, ii. 491.
Bischler, *August*, and *Martin* **Lang**, phenometadiazine derivatives, i, 250.
Bischler, *August*, and *H. P.* **Muntendam**, phenometadiazine derivatives, i, 398.
Bischoff, *Carl A.*, and *Paul* **Walden**, ethylenic salts of glycollic and oxalic acids, i, 17.
Bishop, *Arthur W.*, *Ludwig* **Claisen**, and *W.* **Sinclair**, hydroxymethylenecamphor, i, 62.
Bistrzycki, *Augustin*, and *J.* **Flatau**, condensation of mandelic acid with phenols, i, 419.
Blacher, *Carl*, synthesis with sodamide derivatives, i. 289.
Blackman, *F. Frost*, vegetable assimilation and respiration. The carbonic anhydride exchanges of plants, ii, 520.
Blalock, *Thomas L.* See *H. N.* **Morse**.
Blank, *R.*, addition of aniline and phenylhydrazine to methylic benzylidenemalonate, i, 227.
Blanshard, *Charles T.*, position of magnesium in the genetic system of the elements. Atomic volumes. Allotropes and isomerides, ii, 107.
—— rôle of atomic heat in the periodic series of the elements, ii, 198.
—— melting points of the elements as a clue to their genesis, ii, 340.
Blaxall, *F. R.* See *A.* **Macfayden**.
Bleibtreu, *Leopold*. See *H.* **Wendelstadt**.
Bleibtreu, *Max*, estimation of blood corpuscles, ii, 122.
Bloxam, *W. Popplewell*, the sulphides and polysulphides of ammonium, TRANS., 277.
Blumer, *A.* See *T.* **Curtius**.
Blyth, *Alexander Wynter*, identificacation and estimation of carbohydrates in milk, ii, 425.
Board, *Gregory*, obituary notice of, TRANS., 1112.
Bock, *Oscar*, valve pipette, ii, 525.
Bodenstein, *Max*, fusion of stearolic and behenolic acids with potash, i, 126.
Bodländer, *Guido*, composition of polybasite, ii, 115.
—— the gasgravimeter, ii, 287.
—— solubility in mixtures of alcohol and water, ii, 308.
Boeckler, *August*. See *W.* **Wislicenus**.
Bödtker, *Eyvind*, estimation of chlorine in urine, ii, 62.
Böhm, *E.*, isomeric forms of diacetylthymoquinoxime, i, 529.
Böhm, *E.* See also *F.* **Kehrmann**.
Bömer, *A.*, Kjeldahl's process of estimating nitrogen in foods, ii, 528.
Bömer, *A.* See *C.* **Uffelmann**.
Böniger, *M.*, 1 : 2-amidonaphtholsulphonic acids, i, 106.
Boeris, *G.* See *G.* **Ciamician**.
Böttcher, *O.*, feeding with grain, ii, 453.
Boettinger, *Carl*, carbamide derivatives of tribromopyruvic acid, i, 12.

Boettinger, *Carl*, preparation of thiouvinuric acid (amidothiazolecarboxylic acid), i, 73.
—— derivatives of α-naphthylamine, i, 106.
—— α-dinaphthalidocitric acid, i, 106.
—— glyoxylic acid, i, 170, 367, 525.
—— derivatives of gallic acid, i, 180.
—— scarlet acid, i, 388.
—— the glucosazone from sumach and from vallonia, ii, 407.
—— estimation of fat in milk, ii, 299.
Bogomolow, application of dyes to the recognition and distinction of diverse proteïds, ii, 376.
Bogorodski, *A.*, compounds of lithium bromide and chloride with $3H_2O$, ii, 350.
—— double compound of lithium and lead iodides, ii, 350.
Bohland, *Karl*, levulose and diabetes, ii, 281.
Boisbaudran, *Paul E. Lecoq de*, atomic weights, ii, 257.
—— formation of crystals at the bottom of a solution heavier than themselves, ii, 384.
—— classification of the chemical elements, ii, 440.
—— volumes of salts in their aqueous solutions, ii, 486, 487.
Bokorny, *Thomas*, action of dilute alkalis on lower animals and plants, ii, 174.
—— effect of calcium and magnesium on the development of the organised structures of the cell, ii, 457.
Bolam, *Herbert W.*, hydrolysis of ethylic dicarboxyglutaconate, i, 83.
Bolam, *Herbert W.* See also *T.* **Purdie.**
Bomboletti, *A.*, avoidance of error in hydrotometric analysis, ii, 32.
Bondzyński, *Stanislas*, and *Rudolf* **Gottlieb**, methylxanthine, a product of the metathesis of theobromine and caffeïne, i, 434.
Bone, *William A.*, and *John C.* **Cain**, the incomplete combustion of some gaseous carbon compounds, Proc., **1894**. 179.
Bone, *William A.*, and *William H.* **Perkin**, jun., the condensation of ethylic trimethylenedicarboxylate with ethylic malonate, Trans., 108.
—— —— trimethylsuccinic and dimethylglutaric acids, Trans., 416.
Bonney, *T. G.*, and *Miss C. A.* **Raisin**, rocks and minerals from the Karakoram Himalayas, ii, 51.
Boole, *Lucy Everest*. See *W. R.* **Dunstan.**
Boorsma, *P. A.*, some indicators, ii, 325.
Boot, *J. C.*, apparatus for the rapid calibration of measuring vessels, ii, 368.
Born, *Georg*. See *R.* **Scholl.**
Bornträger, *Arthur*, influence of normal or basic lead acetate on invert sugar, ii, 143.
—— procedure in Fehling's titration, ii, 187.
—— potassium hydrogen tartrate as material for standardising alkalis, ii, 289.
—— influence of the lead acetates on the estimation of invert sugar, ii, 296.
—— potassium tetroxalate for titrating alkalis, ii 532.
Bošek, *Otto*, action of hydrogen sulphide on antimonic acid solutions, Trans., 515.
Boseley, *L. Kidgell*. See *H. D.* **Richmond.**
Bothof, *Heinrich*. See *R.* **Nietzki.**
Bouchardat, *Gustave*, and **Tardy**, alcohols derived from a dextrorotatory terpene, eucalyptene, i, 673.
Bourgeois, *Léon*, and *Hermann* **Traube**, artificial dolomite, ii, 401.
Bourquelot, *Émile E.*, trehalose in mushrooms, i, 199.
—— methylic salicylate in indigenous plants, ii, 177.
—— the time of trehalose formation in plants, ii, 362.
Bouveault, *Louis*, some points in stereochemistry, i, 243.
Bouveault, *Louis*, and *L.* **Rousset**, valeraldehyde, i, 168.
Bouveault, *Louis*. See also *P.* **Barbier.**
Boyd, *F. D.*, albuminuria, ii, 82.
Brandl, *Josef*, pharmacological investigation of Manaca roots, ii, 57.
Brandstätter, *Friedrich*, lecture experiments: ethyl ether, ii, 73.
Brandt, *Gustav*. See *A.* **Claus.**
Braun, *Eduard*, β-metatolyl-αγ-diketohydrindene, i, 535.
Brauner, *Bohuslav*, action of hydrogen sulphide on solutions of antimonic, arsenic, and telluric acids, Trans., 527.
—— on the atomic weight of tellurium, Trans., 549.
—— gases of the helium and argon type, ii, 347.
—— cerium, ii, 352.
Brauns, *Reinhard*, action of dry hydrogen chloride on serpentine, ii, 316.

Braunschweig, *Emil*. See *R*. **Nietzki.**

Bréal, *Émile*, nutrition of plants by humus and organic substances, ii, 28.

Bredig, *Georg*, influence of centrifugal force on chemical systems, ii, 490.

Bredt, *Julius*, camphoronic acid, i, 242.

Bredt, *Julius*, and *Wilhelm* **Posth**, alantolactone (helenin), i, 555.

—— —— absorption apparatus for elementary analysis, ii, 417.

Bredt, *Titus V*. See *K*. **Auwers.**

Breed, *Mary B*. See *E. H*. **Keiser.**

Bremer, *Hermann*, Hübl's iodine absorption method, ii, 374.

Brochet, *André*, action of chlorine on secondary alcohols, i, 259.

—— action of halogens on methylic alcohol, i, 637.

Brochet, *André*, and *R*. **Cambier**, action of formaldehyde on hydroxylamine and methylamine hydrochlorides, i, 325.

—— —— action of formaldehyde on ammonium salts, i, 326.

Brochet, *André*. See also *R*. **Cambier.**

Bronnert, *Emil*. See *R*. **Fittig**, *A*. **Schneegans.**

Brown, *Amos P*., chemical character of pyrites and marcasite, ii, 316.

Brown, *Horace T*., and *G. Harris* **Morris**, note on the action of diastase on cold starch paste, Trans., 309.

—— —— on the isomaltose of C. J. Lintner, Trans., 709.

Bruce, *David*, disappearance of leucocytes from blood after peptone injection, ii, 79.

Bruce, *James*. See *W. P*. **Wynne.**

Brühl, *Julius W*., etherification and hydrolysis, i, 593.

—— spectrochemistry of nitrogen, ii, 194, 250.

Brunck, *Otto*, estimation of antimony as tetroxide, ii, 372.

Brunel, *H*. See *L* **Zorn.**

Bruner, *Louis*, solidification of some carbon compounds, ii, 378.

—— specific heat of superfused salts, ii, 482.

—— solubility of superfused salts, ii, 488.

Brunner, *Heinrich*, and *Ernest* **Chuard**, glyoxylic acid in green fruits, ii, 409.

Brunner, *Karl*, formation of propyltartronic acid from dibutyryldicyanides, i, 355.

Brunner, *Karl*, new synthesis of 2′ : 3′-dimethylindole, i, 475.

Bruns, *E*., preparation of the three nitranilines, i, 657.

Brunton, *T. Lauder*, and *A. Sheridan* **Delépine**, changes in liver cells, ii, 79.

Bruyn, *Cornelius A. Lobry de*, ammonia derivatives of *d*-glucose, i, 640.

—— action of sodium and caustic alkalis on polynitro-derivatives, i, 653.

—— influence of the methyl group on the properties of nitro-groups, i, 654.

—— free hydrazine, ii, 347.

—— hydrazine hydrate, ii, 496, 497.

Bruyn, *Cornelius A. Lobry de*, and *Frederik H. Van* **Leent**, maltose and its anhydride, i, 7.

Bryk, *Ernst*, action of iodine and potassium hydroxide on uric acid, i, 84.

Buchanan, *John Y*., on the use of the globe in crystallography, Proc., **1894**, 226.

Buchner, *Eduard*, ethylic diazoacetate and picric acid, i, 140.

—— phenyl derivatives of pyrazole, i, 192.

—— ethylic mercuridiazoacetate, i, 203.

—— trimethylenepolycarboxylic acids, i, 269.

Buchner, *Eduard*, and *August* **Papendieck**, action of ethylic diazoacetate on unsaturated ethylic salts, i, 250.

—— —— *trans*-1 : 2-trimethylenedicarboxylic acid, i, 269.

Buchner, *Eduard*, and *Hugo* **Witter**, *trans*-1 : 2 : 3-trimethylenetricarboxylic acid, i, 239.

Bücking, *Hugo*, sulfoborite, ii, 276.

Bülow, *K*., ash free albumin, i, 196.

Bünte, *C*., modification of the Reichert-Meissl butter process, ii, 95.

Bujwid, *Odo*, indole as a test for nitrites, ii, 63.

Burcker, *E*., stability of aqueous solutions of mercuric chloride, ii, 46.

—— estimation of the volatile acids in wines, ii, 538.

Burcker, *E*., and *C*. **Stabil**, action of camphoric anhydride on benzene in presence of aluminium chloride, i, 108.

Burkert, *O*. See *R*. **Stoermer.**

Burr, *Henry C*. See *E. F*. **Smith.**

Burrows, *M. W*., and *W. H*. **Bentley**, methylisobutylacetic acid, Trans., 509.

Busch, *Max*, orthamidobenzylhydrazine, i, 31.

Busch, *Max*, orthamidobenzylamine, i, 306, 307.
Busch, *Max*, and *Hugo* **Roegglen**, benzylorthamidobenzylaniline, i, 133.
Buss, *Hans*. See *A*. **Werner.**
Busse, *George J*. See *C. D*. **Harries.**
Busz, *Karl H. E. G*., kamarezite, ii, 506.

C.

Cailletet, *Louis P*., and *Emmanuel* **Collardeau**, condensation of electrolytic gas by porous substances, especially metals of the platinum group, ii, 150.
Cain, *John C*., hydrolysis of aromatic nitriles, i, 345.
Cain, *John C*. See *W. A*. **Bone.**
Cambier, *R*., and *André* **Brochet**, production of gaseous formaldehyde for disinfecting purposes, i, 167.
—— —— constitution of hexamethylenetetramine, i, 262.
—— —— action of formaldehyde on amines, i, 641.
Cambier, *R*. See also *A*. **Brochet.**
Cameron, *F. K*. See *W. R*. **Orndorff.**
Campbell, *Edward D*., and *W. H*. **Andrews**, separation of nickel from iron, ii, 293.
—— —— estimation of nickel in nickel-steel, ii, 421.
Campbell, *George F*., cæsium cobalt and cæsium nickel double haloïds, ii, 165.
Campredon, *Louis*, estimation of sulphur in iron and steel, ii, 411.
Candiani, *P*., ethenylic trisulphide, i, 585.
Cannizzaro, *Stanislao*, and *Americo* **Andreocci**, 1 : 4-dimethylnaphthol, i, 424.
Cantoni, *Ludovico*, and *Luigi* **Carcano**, periodic estimation of volatile fatty acids in butter produced during a year, ii, 95.
Canzoneri, *Francesco*, commercial Thapsia resin, i, 385.
Carcano, *Luigi*. See *L*. **Cantoni.**
Cari-Mantrand, *Maxime*, carbon tetrachloride and the purification of methylated alcohol, i, 488.
Carnot, *Adolphe*, estimation of small quantities of arsenic, ii, 531.
Caro, *N*. See *A*. **Pinner.**
Caroselli, *Arnaldo*. See *A*. **Claus.**
Carr, *Francis H*. See *W. R*. **Dunstan.**
Carrara, *Giacomo*, selenitines, i, 8.
—— a colour reaction of carbazole, i, 422.
Carrara, *Giacomo*, velocity of reaction between alkylic sulphides and alkylic iodides, ii, 8.
—— electrolytic dissociation and the law of dilution in organic solvents, ii, 302.
Carrara, *Giacomo*, and *G*. **Gennari**, relation between electrolytic dissociation and optical rotation, ii, 301.
Carteighe, *John*, obituary notice of, Trans., 1112.
Causse, *Henri E*., bismuth nitrosalicylates, i, 179.
Cavalier, *J*., allylphosphoric acid, i, 638.
Cazeneuve, *Paul*, triacetylgallic acid, i, 420.
Cazeneuve, *Paul*, and *E*. **Haddon**, discoloration and coagulation of milk by heat, i, 640.
Cesaris, *P*., cadmium salicylate, i, 281.
Chabrié (*P*.) *Camille*, aromatic selenium compounds, i, 413.
—— chemical phenomena of ossification, ii, 518.
Chalmot, *Guillame J. L. de*, formation of pentosans in plants, i, 7.
—— oxidation of complex carbohydrates, i, 587.
—— pentosans in plants, ii, 176.
Chancel, *Felix*, nitrosopropylacetamide, i, 495.
Chapman, *Alfred C. A. W. H*., essential oil of hops, Trans., 54.
—— some derivatives of humulene, Trans., 780.
Charpy, *Georges*, temperatures of transformations of irons and steels, ii, 110.
Charpy, *Georges*. See also *H*. **Moissan.**
Chassy, *A*., electrolysis of copper sulphate, ii, 4.
Chatin, *G*., *Adolphe* and *Achille* **Müntz**, oyster shells, ii, 279.
—— —— phosphorus in oysters, ii, 456.
Chattaway, *Frederick D*., ββ-dinaphthyl and its quinones, Trans., 653.
Chattaway, *Frederick D*., and *Harry* **Ingle**, a new series of hydrazines, Trans., 1090.
Chattaway, *Frederick D*. See also *E*. **Bamberger.**
Chavanne, *L*. See *P. A*. **Guye.**
Chicandard, *G*. See *A*. **Seyewetz.**
Chikashigé, *Masumi*, mercury perchlorates, Trans., 1013.
—— preparation of nitric oxide, ii, 163.
—— decomposition of sulphates by ammonium chloride, ii, 185.
Choina, *J*. See *S*. **Tanatar.**
Chorley, *John C*., constant level apparatus, ii, 162.
Chorley, *John C*. See also *E. C. C*. **Baly** and *R. T*. **Plimpton.**

Christomanos, *Anastasios K.*, apparatus for the estimation of carbonic anhydride, ii, 31.
—— artificial ice, ii, 73.
Chuard, *Ernest*. See *H.* **Brunner.**
Chudiakow, *N. v.*, alcoholic fermentation, ii, 282.
Church, *Arthur H.*, a basic ferric sulphate, ii, 506.
—— analyses of some arsenates and phosphates, ii, 507.
Ciamician, *Giacomo L.*, properties of the dihydroquinolines: constitution of ring systems containing nitrogen, i, 111.
Ciamician, *Giacomo L.*, and *G.* **Boeris**, constitution of the hydroquinolines, i, 392.
Ciamician, *Giacomo L.*, and *Paul* **Silber**, alkaloïds from the rind of pomegranate root, i. 160.
—— —— constitution of maclurin and phloretin, i, 538.
—— —— phenylcoumalin and dicotoïn, i, 554.
Claisen, *Ludwig*, hydroxymethylene compounds, i, 62.
—— preparation of benzoic anhydride, i, 139.
—— *a*-diketones, i, 647.
—— constitution of *n*-phenylpyrazolone, i, 686.
Claisen, *Ludwig*, and *Thomas* **Ewan**, action of ethylic oxalate on dibenzyl ketone, i, 373.
Claisen, *Ludwig*, and *E.* **Haase**, action of phenylhydrazine on ethylic ethoxymethylenemalonate, i, 193.
Claisen, *Ludwig*. See also *A. W.* **Bishop.**
Clarency, *A.*, optical method for estimating albumin and uric acid in urine, ii, 190.
Clark, *Edmund*, estimation of chromium in chrome ore, ii, 294.
Clarke, *Thomas*. See *F. P.* **Venable.**
Classen, *Alexander*, and *Walther* **Löb**, action of iodine on phenolphthalein, i, 539.
Claus, *Adolph*, so-called stereochemistry of nitrogen, i, 200.
—— tautomerism, i, 257.
—— dibromosebacic acids, i, 267.
—— the isomeric diazobenzene potassium sulphites, i, 274.
—— cyaphenine: substituted benzonitriles, i, 344.
Claus, *Adolph*, and *Alfred* **Ammelburg**, 2 : 4-dichloroquinolines, i, 392.
Claus, *Adolph*, and *Gustav* **Brandt**, paramethoxy-α-phenylcinchoninic acid, parahydroxycinchoninic acid, and parahydroxy-α-phenylcinchonine, i, 114.
Claus, *Adolph*, and *Arnaldo* **Caroselli**, 1 : 3-dibromoquinoline, i, 565.
Claus, *Adolph*, and *Carl* **Gutzeit**, isoquinoline derivatives, i, 683.
Claus, *Adolph*, and *Alex.* **Seelemann**, isoquinolinesulphonic acids, i, 684.
Claus, *Adolph*, and *Jacob* **Steinitz**, ethereal salts and betaïnes of quinolinesulphonic acids, i, 111.
—— —— alkyl derivatives of quinaldine-β-carboxylic acid, i, 112.
Claus, *Adolph*, and *F.* **Wolf**, 1 : 4-dibromoquinoline, i, 567.
Clayton, *George C.*, synthesis of dihydroglyoxalines, i, 567.
Clement, *A. A.* See *A. A.* **Noyes.**
Clemons, *C. F.* See *F. A.* **Gooch.**
Clennell, *J. E.*, estimation of alkali hydroxides and carbonates in the presence of alkali cyanides, ii, 185.
Clève, *Per T.*, the life-work of Marignac, TRANS., 468.
—— helium in Clèveite, ii, 347.
—— specific gravity of helium, ii, 498.
Cloedt, *E. von.* See *P.* **Jannasch.**
Clowes, *Frank*, composition of atmospheres that extinguish flame, ii, 443.
—— composition of extinctive atmospheres produced by flames, ii, 494.
Coates, *Charles E.* See *I.* **Remsen.**
Coggeshall, *George W.*, constancy of the calomel electrode, ii, 377.
Cohen, *Ernst*, action of hydrogen on photographic dry plates, ii, 265.
Cohen, *Julius B.*, and *W. Reginald* **Ormandy**, amalgamated aluminium as a reducing agent, ii, 394.
Cohen, *Julius B.* See also *W. H.* **Archdeacon** and *H. R.* **Hirst.**
Cohn, *H.*, nutritive value of cocoa, ii, 61.
Cohn, *Paul*, derivatives of phenylindoxazen, i, 371.
—— orthophenylbenxylamine and cyclophenylenebenzylidene oxide, i, 537.
Cohn, *Paul*. See also *R. J.* **Knoll.**
Cohn, *Rudolph*, leucine from pancreatic digestion, i, 83; ii, 25.
—— physiological action of certain pyridine, naphthalene, and quinoline derivatives, ii, 56.
Cohnstein, *Wilhelm*, action of intravenous injection of sodium chloride on the composition of blood and lymph, ii, 173, 362.
Coleman, *Arthur P.*, antholite from Elzivir, Colorado, ii, 116.
Collan, *Uno*, estimation of sulphurous and sulphuric acids in the products

of the combustion of coal-gas, ii, 368.
Collardeau, *Emmanuel*. See *L. P.* **Cailletet.**
Collie, *John Norman*, a new form of barometer, Trans., 128.
—— action of heat on ethylic β-amidocrotonate. Part II. Trans., 215.
Collie, *John Norman*. See also *W.* **Ramsay** and *Miss A. P.* **Sedgwick.**
Colls, *P. C.* See *W. D.* **Halliburton.**
Colson, *Albert*, cyano-ethers, i, 257.
—— a new class of nitriles, i, 257.
—— Guye's formula, ii, 473.
Combes, *Alphonse*, some points in stereo-chemistry, i, 108.
—— hexamethylene derivatives, i, 338.
—— valency of beryllium, ii, 224.
—— stereochemistry, i, 243.
Conrad, *Max*, and *L.* **Schmidt**, action of thiocarbamide on ethylic bromomalonate and bromo- and dibromolevulinic acid, i, 495.
Conroy, *James T.* See *O.* **Wallach.**
Cooper, *William J.* See *A. J.* **Wanklyn.**
Coote, *Arthur H.* See *W. R.* **Hodgkinson.**
Cope, *Frank*. See *A. G.* **Perkin.**
Coppet, *L. C. de*, temperature of maximum density of water, ii, 343.
—— temperature of maximum density and freezing points of cane sugar solutions, ii, 343.
Costa-Sena, *J. A. da*, actinolite from Ouro-Preto, Brazil, ii, 116.
Councler, *Constantin*, action of phloroglucinol on sugars, i, 164.
—— new process for estimating furfuraldehyde and pentosans, ii, 144.
Cousin, *H.*, halogen derivatives of catechol, i, 456.
Couvée, *J. J.*, paradiazobenzenesulphonic acid as a reagent in water analysis, ii, 332.
Cramer, *Lüppo*, derivatives of caffeïne, i, 116.
Cremer, *Max*, sugar and cells, ii, 360.
Crépieux, *Pierre*. See *A.* **Pictet.**
Crompton, *Holland*, on latent heat of fusion, Trans., 315.
Crompton, *Holland* and *Miss M. A. Whiteley*, the melting point of mixtures, Trans., 327.
Croockewitt, *J. M.*, salivary glands of the leech, ii, 53.
Crosa, *F.* See *E.* **Paternò.**
Cross, *Charles F.*, *Edward J.* **Bevan**, and *Clayton* **Beadle**, contributions to the chemistry of cellulose, Trans., 433.
Cross, *Charles, F.*, *Edward J.* **Bevan**, and *Claud* **Smith**, origin of unsaturated compounds in plants, i, 640.
Cundall, *James T.*, dissociation of liquid nitrogen peroxide. Part II. The influence of the solvent, Trans., 794.
Cuneo, *G.* See *G.* **Pellizzari.**
Curatolo, *A.* See *G.* **Oddo.**
Curtiss, *Richard, S.*, acetylacetone: ethylic acetoacetate, i, 501.
Curtius, *Theodor*, hydrazides and azides of the organic acids, i, 32.
—— derivatives of hydrazine having a closed chain structure, i, 246.
—— acid hydrazides and azides, i, 276.
Curtius, *Theodor*, and *A.* **Blumer**, action of hydrazine hydrate on benzoïn and deoxybenzoïn, i, 606.
Curtius, *Theodor*, and *G. M.* **Dedichen**, synthesis of aromatic hydrazines from hydrazine hydrate, i, 29.
Curtius, *Theodor* and *Hans A.* **Foersterling**, action of hydrazine hydrate on phthalic and maleïc anhydrides, i, 354.
Curtius, *Theodor*, and *Karl* **Heidenreich**, carbonyl nitride and dicarbamide, i, 12.
Curtius, *Theodor*, *G.* **Schöfer**, and *Nicolaus* **Schwan**, hydrazides of the fatty series, i, 263.
Curtius, *Theodor*, and *F.* **Schrader**, metallic double salts of diammonium and diamide, ii, 10.
Curtius, *Theodor*, and *Nicolaus* **Schwan**, substituted ethereal salts of glycollic acid: glycolylhydrazine, i, 331.
Curtius, *Theodor*, and *O.* **Trachmann**, nitrobenzoylhydrazines, i, 276
Curtius, *Theodor*, and *F.* **Wirsing**, pyrazoline and its derivatives, i, 248.
Cushman, *Allerton S.*, separation of copper from cadmium, ii, 371.
—— detection and estimation of strychnine in corpses, ii, 542.
Cybulski, *Gustav*. See *C. T.* **Liebermann.**

D.

Daccomo, *Girolamo*, filicic acid, i, 68.
Dahl, *O. W.* See *W. A.* **Hancock.**
Daikuhara, *G.*, reserve proteïn in plants, ii, 128.
Dains, *Frank B.*, action of acid chlorides on methyl paraisobutylphenyl ether, i, 289.
Dains, *Frank B.*, and *I. R.* **Rothrock**, paraisobutylsalicylaldehyde and its derivatives, i, 222.

Dains, *Frank B.*, and *I. R.* **Rothrock,** bromine derivatives of parisobutylphenol. i, 273.
Damseaux, *A.*, effect of sulphurous acid on soil and its produce, ii, 366.
Dapper, *Karl,* uric acid excretion, ii, 520.
D'Arcy, *R. F.*, and *W. B.* **Hardy,** bactericidal action of light and air, ii, 57.
Dastre, *A.*, fibrinolysis, ii, 300.
Davidson, *W. B.* See *F. R.* **Japp.**
Davoll, *David L., jun.*, fallacies of *post mortem* tests for morphine, ii. 375.
Dedichen, *G. M.* See *T.* **Curtius.**
Deeley, *R. M.*, refraction equivalents of the elements and the periodic law, Proc., **1895**, 10.
Deerr, *N. F.*, note on the latent heat of fusion. Proc., **1895**, 125.
Dehérain, *Pierre P.*, drainage from cultivated land, ii, 133, 458
—— experiments on wheat and barley at Grignon, ii, 179.
Delacre, *Maurice,* synthesis of anthracene. i, 379.
Delépine (*A.*) *Sheridan.* See *T. L.* **Brunton.**
Delépine, *Marcel,* combination of hexamethylenetetramine with silver salts, i, 261.
—— action of ammonia on methylenic chlorobromide, i, 262.
—— action of ammonia on methylenic chloride, i, 262.
—— hexamethylenetetramine, i, 326.
—— hexamethylenetetramine compounds, i, 444.
—— reduction of hexamethylenetetramine to trimethylamine. i, 493.
—— hexamethylenetetramine salts, i, 590.
—— hexamethylenetetramine bismuthiodides, i, 591.
—— Kjeldahl's method and platinochlorides, ii, 290.
Demoussy, assimilation of nitrates by plants, ii. 125.
Demyanoff, *Nikolaus,* methyltrimethylene, i, 161.
Denigès, *Georges,* mercuric compounds of thiophen. Estimation of thiophen in benzene, i, 411.
—— the hydrobromic acid test for copper, ii, 330.
—— estimation of thiophen in benzene, ii 332, 372.
Deninger, *Albert,* preparation of benzoic anhydride, i, 178.
—— modification of the Baumann-Schotten method, i, 461.
—— carbon monosulphide, ii. 222.
Dennis, *L. M.* crystalline aluminium chloride, ii, 447.
Dennis, *L. M.*, and *W. H.* **Magee,** cerium compounds, ii, 15.
Dennstedt, *Maximiliano,* and *Cæsar* **Ahrens,** action of nitrous acid on indene and coumarone, i, 475.
Deraux, *E.* See *E.* **Doumer.**
Derby, *Orville A.*, Cañon Diablo meteorite, ii, 319.
Desbout, *Konstantin.* See *A.* **Faworsky.**
Desch, *Cecil H.* See *R. C.* **Evans.**
Desesquelle, *Edouard,* mercuric phenoxides and naphthoxides, i, 86.
Desgrez, *Alexandre,* hydration of allylene, i, 197.
—— hydration of acetylene. Formation of paraldehyde, i, 197.
Deslandres, *Henri,* spectra of gases from Cleveite and the solar spectrum, ii, 431.
Desi, *En. D.* See *E. F.* **Smith.**
Dewar, *James,* phosphorescence and photographic action of the temperature of boiling liquid air, Proc., **1894**, 171.
—— the relative behaviour of chemically prepared and of atmospheric nitrogen, Proc., **1894**, 222.
Dewar, *James.* See also *G. D.* **Liveing.**
Dick, *Allan B.*, Geikielite, ii, 509.
Diepolder, *Emil.* See *O.* **Fischer.**
Dimroth, *Otto,* and *Johannes* **Thiele,** reduction of nitrobenzylic chloride, i, 344.
Dimroth, *Otto.* See also *J.* **Thiele.**
Ditte, *Alfred,* silver sulphide, ii, 223.
—— bismuth sulphide, ii, 273.
—— gold sulphide, ii, 274.
Divers, *Edward,* the acid sulphate of hydroxylamine, Trans., 226.
Divers, *Edward,* and *Tamemasa* **Haga,** potassium nitrososulphates, Trans., 452.
—— —— sodium nitrososulphate, Trans., 1095.
—— —— the constitution of nitrososulphates, Trans., 1098.
Dixon, *Augustus E.*, substitution derivatives of urea and thiourea, Trans., 556.
—— acidylthiocarbimides, Trans., 1040.
Dixon, *Augustus E.*, and *Robert E.* **Doran,** derivatives of succinyl- and phthalyl-dithiocarbimides, Trans., 565.
Dobbie, *James J.*, and *Alexander* **Lauder,** corydaline. Part IV. Trans., 17.
—— —— the alkaloïds of *Corydalis cava:* corybulbine, Trans., 25.
Dobreff, *N.*, action of phthalic chloride on nitraniline, i, 360.
Dobriner, *Paul,* sources of error in alkalimetry, ii, 410.

Doebner, *Oscar G.*, quinoline bases in brown-coal tar, i, 244.
—— occurrence of citronellal in citron oil, i. 382.
—— quinoline in brown-coal tar, i, 392.
—— brucine hydropolysulphide. i, 403.
Doebner, *Oscar G.*, and *Eduard* **Ferber**,, α-alkylcinchonic acids and α-alkylquinolines amido-derivatives of α-phenylcinchonic acid, i, 72.
Doebner, *Oscar G.*, and *Hans* **Fettback**, α-alkycinchonic acids and α-alkylquinolines, carboxylic and hydroxy derivatives of α-phenylcinchonic acid, i, 71.
Doelter, *Cornelius*, dimorphous minerals, ii, 49.
Donald, *J. T.*, asbestos and some associated minerals, ii, 116.
—— scolecite from Canada, ii, 116.
Donciu, *Léon*, action of chlorine on ethylenic glycol, i, 319.
Doran, *Robert E.* See *A. E.* **Dixon.**
Dormeyer, *C.*, estimation of fat in animal organs, ii. 540.
Doroschewsky, *A.* See *N.* **Zelinsky.**
Dosmond, gases from wood charcoal at a high temperature, ii, 109.
Doss, *Bruno*, artificial preparation of anatase and rutile, ii. 21.
Doumer, *Emmanuel*, and *E.* **Deraux**, solubility of quinine in alkalis, ii, 299.
Drechsel, *Edmund*, reduction of alkaline copper solutions by proteïds, i. 600.
Drown, *Thomas M.*, and *George F.* **Eldridge**, volatility of stannic chloride, ii, 140.
Duboin, *André*, magnesium fluorides and silicates, ii, 351.
Dubois, *H. W.* See *C. T.* **Mixer.**
Duden, *Paul*, formation of hydrazine from inorganic compounds, ii. 74.
Duden, *Paul*, and *Max* **Scharff**, action of formaldehyde on methylamine and ammonia, i, 325.
Dühring, *Ulrich*, law of corresponding boiling points, ii, 37, 154.
Düll, *George.* See *C. J.* **Lintner.**
Düring, *Frz.*, action of thionylaniline on the xylenediamines, i, 345.
Dulin, *R. S.*, wet copper assay, ii, 419.
Dumble, *E. J.*, Grahamite from Texas, ii, 20.
Dunstan, *Wyndham R.*, and *Lucy E.* **Boole**, vesicating constituent of croton oil, i, 680.
Dunstan, *Wyndham R.*, and *Francis H.* **Carr**, contributions to our knowledge of the aconite alkaloïds. Part XI. The constitution of aconitine: acetyl derivatives of benzaconine and aconitine, Trans., 459.
Dunstan, *Wyndham R.*, and *Francis H. Carr*, contributions to our knowledge of the aconite alkaloïds. Part XII. The constitution of pseudo-aconitine, Proc., **1895**, 154.
—— —— constitution of aconitine, i, 631.
Dunstan, *Wyndham R.*, and *Henry* **Garnett**, the constituents of *Piper ovatum*, Trans., 94.
—— —— note on the active constituents of the pellitory of medicine, Trans., 100.
Dunstan, *Wyndham R.*, and *Hooper A. D.* **Jowett**, aconitine aurochlorides, Proc., **1895** 27.
Duparc, *L.*, and *L.* **Mrazec**, serpentine of the Binnenthal, i, 117.
Dutto, estimation of peptones, ii. 468.
Dyer, *Bernard*, Kjeldahl's method for the determination of nitrogen, Trans., 811.
Dzimski, *O.* See *R.* **Stoermer.**

E.

Eagles, *Edwin M.* See *M. M. P.* **Muir.**
Eakins, *L. G.*, and *Henry N.* **Stokes**, analyses of heulandite and Smithsonite, ii, 510.
Eakle, *Arthur S.*, and *Wilhelm* **Muthmann**, so-called Schneebergite, ii, 512.
Ebel, *Ludwig.* See *E.* **Lellmann.**
Eberhard, *Otto*, αα-dithienyl, i. 23.
Eckenroth, *Hugo*, and *Karl* **Kock**, diphenylic thiocarbonate, i, 131.
Edeleanu, *Lazar*, and *A.* **Zaharia**, derivatives of cinnamic acid, i, 364.
Edinger, *Albert*, sulphides and hydrosulphides of aromatic bases, i, 300.
—— iodosoquinoline, i, 300.
—— estimation of sulphur and of chlorine with sodium peroxide, ii, 244.
Edmunds, *Arthur*, saturation of normal urine with neutral salts, ii, 237.
Edwards, *Arthur M.*, substitute for funnels in filtering, ii, 162.
Edwards, *Vincent*, estimation of iron and aluminium in phosphates, ii, 140.
—— estimation of soluble phosphate, ii, 184.
—— practical working of Pelouze's process, ii, 370.
Edwards, *W. F.*, new formula for specific and molecular refraction, ii, 193.
—— molecular and atomic refraction, ii, 429.
Effront, *Jean*, amylase, i, 602.

Egeling, *C. Guldensteeden*, testing urine for acetone, ii, 537.

Ehrenberg, *Alexander*, alkaloïds of Calabar beans, i, 436.

Ehrenfeld, *Charles H.*, tungsten and molybdenum and their trioxides, ii, 396.

Ehrich, *E.*, varying composition of malt. Means of regulating the degree of fermentation, ii, 181.

Eiger, *J.*, ethereal hydrogen sulphates in pathological urine, ii, 55.

Eijkman, *Johan F.*, refractometric observations, ii, 33, 65.

Einecke, *Albert*, composition of different kinds of berries, ii, 366.

Einhorn, *Alfred*, technical preparation of cocaïne from its associated alkaloïds, i, 76.

Einhorn, *Alfred*, and *Alfred* **Gernsheim,** nitrophenylglycidic acids, i, 281.

Einhorn, *Alfred*, and *Alexander* **Meyenberg,** reduction of paradimethylamidobenzoic acid and paramidobenzoic acid, i, 91.

Einhorn, *Alfred*, and *Richard* **Willstätter,** isomeric paramethylenedihydrobenzoic acids, i, 92.

Ekenstein, *W. Alberda van*, the second methylglucoside, i, 5.

Ekker, *E. H.*, sodium hyposulphite, ii, 500.

Elbs, *Karl*, and *K.* **Schmitz,** preparation of pinacones by the reduction of aromatic ketones, i, 537.

Eldridge, *George F.* See *T. M.* **Drown.**

Emery, *George F.*, thermoelectric properties of salt solutions, ii, 68.

Emich, *Friedrich*, action of nitric oxide on metals at high temperatures, ii, 11.

—— combustion in nitrogen, ii, 388.

Eminger, *A.* See *A.* **Hilger.**

Ende, *Carl.* See *L. N.* **Andrews.**

Ende, *Theodor A. M.*, pennyroyal oil, i, 153.

Engelhardt, *M.* See *T.* **Zincke.**

Engelmann, *Th. Wilhelm*, separation of oxygen by cells containing chromophyll, ii, 26.

Engels, *Carl*, quantitative separation of metals in alkaline solution by hydrogen peroxide, ii, 419.

Engler, *Carl*, synthesis of indigo blue, i, 231.

Ephraim, *Julius*, Hübl's iodine method, ii, 428.

Erdmann, *G.* See *C. A. A.* **Milhaelis.**

Erlenmeyer, *Emil., jun.*, diacetylcreatine and benzylideneacetylcreatinine, i, 310.

Erlenmeyer, *Emil, jun.*, isohydroxydiphenylethylamine from glycocine and benzaldehyde, i, 596.

Erlenmeyer, *Emil*, and *Ernst* **Frustück,** phenyl-α-amidolactic acid (phenylserine), i, 281.

Erp, *H. van*, aliphatic nitramines, i 587.

Errera, *Giorgio*, action of hydroxylamine on camphoric anhydride, i, 382.

—— action of potassium hypobromite on camphoric amide, i, 383.

—— action of hydroxylamine on phthalic anhydride, i, 417.

Étaix, *L.*, extraction apparatus, ii, 43.

Étard, *Alexandre L.*, presence of several distinct chlorophylls in the same vegetable species, i, 66.

—— chlorophylls from lucerne, i, 389.

—— saturated solutions, ii, 344.

Euler, *Hans.* See *C.* **Friedheim.**

Evans, *Philip N.*, obituary notice of, Trans., 1113.

Evans, *Reginald E.*, and *Cecil H.* **Desch,** sodium hydrogen sulphide, ii, 349.

Evans, *Thomas*, and *I. E.* **Beach,** the Twitchell method for estimating rosin in soap, ii, 190.

Ewan, *Thomas*, rate of oxidation of phosphorus, sulphur, and aldehyde, ii, 213.

—— absorption spectra of dilute solutions, ii, 433, 471.

Ewan, *Thomas.* See also *L.* **Claisen.**

Ewing, *Arthur R.* See *C. C.* **Henderson.**

Eyk, *J. van*, sodium cobalt nitrite as a reagent for potassium, ii, 87.

F.

Fabre, *Charles*, **Garrigou, and Surre,** estimation of alcohol in so-called essential oils, ii, 141.

Fabris, *Guido.* See *G. de* **Negri.**

Fairbanks, *Charlotte.* See *F. A.* **Gooch.**

Fasbender, *R.*, double chlorides of the alkali metals and gold, ii, 319.

Fauvet, *Charles* See *M.* **Freund.**

Favre, *C.*, condensation of formaldehyde with alcohols of the fatty series in presence of hydrochloric acid, i, 14.

Fawcett, *J.*, piperazine as a solvent of uric acid stones in urine, ii, 56.

Faworsky, *Alexei E.*, and (in part) *Konstantin* **Desbout,** action of hypochlorous acid on disubstituted acetylene hydrocarbons, i. 496.

Fay, *Irving W.* See *E.* **Fischer.**

Fayollat, *J.* See *P. A.* **Guye.**

Feist, *Franz*, diketohexamethylene from succinic acid, i, 339.

Feist, *Franz*, and *Hugo* **Arnstein**, phenylethylenediamine, i, 274.

Feist, *Franz*, and *Hans* **Belart**, diacetylacetone, i, 498.

Fenton, *Henry J. H.*, a new method of obtaining dihydroxytartaric acid, and the use of this acid as a reagent for sodium, Trans., 48.

—— new formation of glycollic aldehyde, Trans., 774.

—— note on the transformation of ammonium cyanate into urea, Proc., 1895, 138.

Ferber, *Eduard*. See *O.* **Doebner.**

Fernandez-Krug, *Pedro*, and *Wilhelm* **Hampe**, new process for estimating fat in milk, ii, 298.

Ferrand, *Lucien*, thiohypophosphates, ii, 389.

Ferratini, *Adolfo*, dihydroquinolines, i, 69.

Fessenden, *Reginald A.*, measurement of the specific inductive capacities of water, alcohol, &c., ii, 197.

Fettback, *Hans*. See *O.* **Doebner.**

Feurer, *Julius*. See *R.* **Fittig.**

Fileti, *Michele*, the molecular weight of mercurous chloride, ii, 225, 447.

Fileti, *Michele*, and *G.* **Baldracco**, constitution of oxybehenic acid, i, 16.

Fileti, *Michele*, and *Giacomo* **Ponzio**, methyl octyl diketone, i, 15.

—— —— conversion of ketones into α-diketones, i, 499.

Filsinger, *F.*, estimation of starch in compressed yeast, ii, 93.

—— analysis of linseed oil, ii, 147.

Finckh, *Julius*, and *M.* **Schwimmer**, derivatives of auramine, i, 184.

Finkenbeiner, *H.* See *C. T.* **Liebermann.**

Fischer, *Bernhard*, and *Bruno* **Grützner**, mercuric formamide, i, 9.

—— bismuth salts, i, 92.

Fischer, *Emil*, influence of configuration on the action of enzymes, i, 6, 161, 441.

—— syntheses in the sugar group, i, 79.

—— compounds of the sugars with alcohols and ketones, i, 437.

—— combination of polyhydric alcohols with ketones, i, 441.

—— new glucoside allied to amygdalin, ii, 553.

—— volemite, a new heptitol, i, 639.

Fischer, *Emil*, and *Irving W.* **Fay**, idonic acid, idose, iditol, and idosaccharic acid, i, 650.

Fischer, *Emil*, and *Hugo* **Hütz**, preparation of indole derivatives, i, 371.

Fischer, *Emil*, and *Paul* **Lindner**, enzymes of *Schizo-saccharomyces octosporus* and *Saccharomyces Marxianus*, ii, 322.

Fischer, *Gustav*. See *O.* **Fischer.**

Fischer, *M.*, effect of manure, season, and seed on the composition of rye, ii, 179.

Fischer, *Otto*, orthodiamines, i, 57.

—— paradiamidobenzylic sulphide, i, 457.

—— formation of acridine from orthonitrodiphenylmethane, i, 476.

Fischer, *Otto* (and, in part, *H.* **Apitsch**, *E.* **Diepolder**, *M.* **Gmelin**, *W.* **Hofman**, *E.* **Schäfer**), aromatic nitrosobases, i, 597.

Fischer, *Otto*, and *Gustav* **Fischer**, paramidobenzylic alcohol, i, 343.

Fischer, *Otto*, and *Eduard* **Hepp**, fluoresceïnanilides, i, 55.

—— —— the fluorindines, i, 220.

—— —— fluoresceïn ethers, i, 291.

—— —— the induline group, i, 608.

Fischer, *Otto*, and *Oscar* **Jonas**, oxidation of aromatic orthodiamines and orthamidophenols, i, 52.

Fischer, *Otto*, and *Heinrich* **Schmidt**, orthamidodiphenylmethane, i, 52.

Fittig, *Rudolph*, unsaturated acids, i, 16.

—— condensation of aldehydes with glutaric acid, i, 127.

—— intramolecular changes in unsaturated acids, i, 204.

—— crystalline form of bromo- and dibromo-valeric acids, i, 205.

—— intramolecular change in angelic and tiglic acids, i, 205.

—— intramolecular rearrangement of unsaturated acids. So-called phenylhydroxycrotonic acid, i, 533.

Fittig, *Rudolph*, and *Charles F.* **Baker**, intramolecular change in βγ-hexenic (hydrosorbic) acid, i, 206.

Fittig, *Rudolph*, and *E.* **Bronnert**, condensation of isovaleraldehyde with glutaric acid, i, 127.

Fittig, *Rudolph*, and *Julius* **Feurer**, intramolecular change in βγ-isoheptenic acid, i, 206.

Fittig, *Rudolph*, and *Theodor* **Hoffmann**, intramolecular change in phenyl-βγ-pentenic (hydrocinnamenylacrylic) acid, i, 223.

Fittig, *Rudolph*, and *Alfons* **Luib**, intramolecular change in βγ-phenylcrotonic acid, i, 223.

Fittig, *Rudolph*, and *John E.* **Mackenzie**, pentenic acids from the interaction of propaldehyde and malonic acid, i, 201.

Fittig, *Rudolph*, and *Ernst* **Mayer**, oxidation products of phenyl-$\beta\gamma$-pentenic and phenyl-$\alpha\beta$-pentenic acids, i, 225.

Fittig, *Rudolph*, and *Max* **Penschuck,** oxidation of tiglic and angelic acids, i, 205.

Fittig, *Rudolph*, and *Heinrich* **Perrin,** brominated acids from phenyl-$\alpha\beta$-pentenic and phenyl-$\beta\gamma$-pentenic acids, i, 224.

Fittig, *Rudolph*, and *Sebastian* **Roedel,** condensation of benzaldehyde with glutaric acid, i, 141.

Fittig, *Rudolph*, and *Alfred* **Silberstein,** oxidation products of $\beta\gamma$- and $\alpha\beta$-isoheptenic acids, i, 207.

Fittig, *Rudolph*, and *John G.* **Spenzer,** intramolecular change in $\beta\gamma$-pentenic (ethylidenepropionic) acid. Experiments with $\gamma\delta$-pentenic acid, i, 204.

Fittig, *Rudolph*, and *François de* **Vos,** oxidation products of $\beta\gamma$- and $\alpha\beta$-isoctenic acids, i, 208.

Fittig, *Rudolph*, and *Sylvian* **Weil,** intramolecular change in $\beta\gamma$-isoctenic acid, i, 207.

Flatau, *J.* See *A.* **Bistrzycki.**

Fleck, *Hermann*, and *Edgar F.* **Smith,** molybdamides, ii, 48.

Fleissner, *Franz.* See *E.* **Lippmann.**

Fletcher, *Lazarus*, baddeleyite (native zirconia), ii, 505.

Flink, *Gustav*, neptunite, epidymite, katapleite, and ægirine from Greenland, ii, 23.

Focke, *Hermann*, detection of small quantities of sugar in urine, i, 537.

Foerster, *Fritz*, estimation of carbon in iron, ii, 330.

Foersterling, *Hans A.* See *T.* **Curtius.**

Fonzes-Diacon, solubility of strontium bromide in alcohol, ii, 223.

Forch, *Carl*, thermal expansion of aqueous solutions, ii, 339.

Forcrand, *Robert de*, calcium ethoxide, i, 259.

—— heat of formation of calcium carbide, ii, 341.

—— compounds of calcium and barium oxides with alcohol, ii, 341.

—— heat of formation of sodium acetylide, ii, 482.

—— sodamide, ii, 499.

Forster, *Martin O.*, new derivatives from α-dibromocamphor, Proc., **1895**, 4.

Forster, *Martin O.* See *W. A.* **Tilden.**

Fortner, *Paul*, cinchotenine, i, 403.

Foullon, *Heinrich v.*, cadmiferous blende from Mies: Rhodochrosite from Asia Minor, ii, 505.

Foullon, *Heinrich v.*, analyses of nickel-silicate ores, ii, 514.

Fournier, *H.* secondary allylic alcohols, i, 198.

—— glycerols from secondary allylic alcohols, i, 489.

Fraenkel, *Ignaz*, and *Karl* **Spiro,** synthesis of indigo from ethylenedianthranilic acid, i, 536.

Fraenkel, *Sigmund*, derivatives of bromophenylmercapturic acids, i, 284.

Franchimont, *Antoine P. N.*, methylnitramine, i, 445.

Franchimont, *Antoine P. N.*, and *H. A.* **Rouffaer,** amido-derivatives of oxalic acid, i, 449.

Franck, *Léon*, action of aluminium chloride on carbon and its compounds, ii, 167.

Franco, *Pasquale*, aphthalose from Vesuvius, ii, 115.

François, estimation of mercury in presence of iodine, ii, 87.

Frank, *Otto*, decomposition of fatty acids by oxidation at ordinary temperatures in the absence of ferments, i, 125.

Franke, *Emil*, electrical conductivity in aqueous solutions, ii, 252.

Franke, *E.* See *T.* **Pfeiffer.**

Frankfurt, *S.* See *E.* **Schulze.**

Frankland, *Percy F.*, and *James* **Henderson,** some ethereal derivatives of sarcolactic acid, Proc., **1895**, 54.

Freer, *Paul C.*, action of ethylic chlorocarbonate on the sodium derivative of acetone, i, 201.

—— action of sodium on ethylic aconitate and citrate, i, 211.

Freese, *H.* See *A. R.* **Hantzsch.**

Fresenius, (*C.*) *Remigius*, detection of traces of metallic sulphides in precipitated sulphur, ii, 137.

—— detection and estimation of chlorate in bleaching powder, ii, 527.

Fresenius, (*C.*) *Remigius*, and *E.* **Hintz,** estimation of uranium in earths containing phosphoric and arsenic acids, ii, 536.

Fresenius, *Heinrich*, and *A.* **Schattenfroh,** detection and estimation of metals in fatty oils, ii, 463.

Freund, *Ernst*, and *Gustav* **Toepfer,** acidity of urine, ii, 279.

Freund, *Martin*, thebaine, i, 117.

—— thiosemicarbazides, i, 200.

—— history of aconitine, i, 254.

—— action of bromine on thiocarbimides, i, 576.

Freund, *Martin*, and *Ernst* **Asbrand,**

action of bromine on methylthiocarbimide, i, 576.
Freund, *Martin*, and *Gregor* **Bachrach**, action of bromine on ethylthiocarbimide and phenylthiocarbimide, i, 578.
Freund, *Martin*, and *Charles* **Fauvet**, vellosine, an alkaloïd from Pereiro bark, i, 194.
Freund, *Martin*, and *Ernst* **Göbel**, thebaine, i, 402.
Freund, *Martin*, and *Hans* **Hempel**, derivatives of tetrazole, i, 193.
Freund, *Martin*, and *Fritz* **Horst**, αβ-diformylphenylhydrazine and αβ-formylacetylphenylhydrazine, i, 354.
Freund, *Martin*, and *Hans* **Imgart**, dithiourazole and its derivatives, i, 400.
Freund, *Martin*, and *Hugo* **Michaels**, narceïne, i, 630.
Freundler, *Paul*, disubstituted alkylic tartrates, i, 173.
—— secondary ethereal acidyltartrates, i, 210.
—— aromatic acidyltartrates and their anhydrides, i, 267.
—— rotatory power of alkylic β-methyladipates, i, 448.
—— rotatory power of dissolved substances, ii, 194.
—— variations in the rotatory power of tartrates, ii, 338.
Friedel, *Charles*, new series of colouring matters, i, 423.
—— condensation of valeraldehyde, i, 643.
—— thiohypophosphates, ii, 13.
—— classification of the chemical elements, ii, 440.
Friedheim, *Carl*, and *Hans* **Euler**, estimation of molybdenum, ii, 535.
—— —— volumetric estimation of molybdic and vanadic anhydrides in the same solution, ii, 535.
Friedheim, *Carl*, and *Paul* **Michaelis**, separation of arsenic from other elements by means of methylic alcohol and hydrogen, ii, 415.
Friedlaender, *Paul*, nitroquinones, i, 513.
—— reactions of 1 : 3 : 1′-nitronaphthalenedisulphonic acid, i, 543.
—— isomeric naphthalene derivatives, i, 668.
Friedländer, *Paul*, and *M.* **Mosczyc**, derivatives of benzylamine, i, 414.
Friedlaender, *Paul*, and *W.* **Schreiber**, derivatives of anthranil, i, 524.
Friedlaender, *Paul*, and *J.* **Weisberg**, oxidation of nitronaphthalene, i, 543.
—— —— parasubstituted derivatives of α-naphthoic acid, i, 670.
Friedreich, *A.* See *F.* **Ulzer**.
Fritsch, *Paul*, synthesis of isoquinoline derivatives, i, 624.
Fritz, *Franz*. See *C.* **Paal**.
Frobenius, *Ludwig*. See *H. von* **Pechmann**.
Frohman, *E. D.* See *W. A.* **Noyes**.
Fromm, *Emil*, benzylic chloride as a desulphurising agent, i, 461.
—— sulphur derivatives of imidocarboxylic acid, i, 605.
Fromm, *Emil* and *Ernst* **Junius**, methylphenyldithiobiuret and methylphenylthiuret, i, 418.
—— —— condensation of methylphenyldithiobiuret with aldehydes and ketones, i, 418.
Fromm, *Emil*. See also *E.* **Baumann**.
Fromm, *Otto*. See *F.* **Mylius**.
Fromm, *P.*, aromatic arsenites, i, 340.
Früstück, *Ernst*. See also *E.* **Erlenmeyer**, jun.
Funaro, *Angiolo*, poisoning by barium salts, ii, 322.

G.

Gaab, *Karl*. See *K.* **Seubert**.
Gabriel, *Siegmund*, preparation of phenylnitromethane, i, 23.
Gabriel, *Siegmund*, and *Franz* **Müller**, phthalazine, i, 568.
Gabriel, *Siegmund*, and *Theodor* **Posner**, halogenised amines, i, 190, 432.
—— —— derivatives of orthonitrobenzylic thiocyanate, i, 432.
Gärtner, *G.* See *C.* **Hell**.
Gallivan, *F. B.* See *C. L.* **Jackson**.
Gantter, *Friedrich*, gasometric method of estimating nitrogen in nitrates, ii, 183.
—— medico-legal detection of blood stains, ii, 376.
—— gasometric estimation of glycerol, ii, 537.
Garelli, *Felice*, freezing points of isomorphous mixtures, ii, 206.
Garelli, *Felice*, and *C.* **Montanari**, cryoscopic behaviour of substances having constitutions similar to that of the solvent, ii, 205.
Garnett, *Henry*. See *W. R.* **Dunstan**.
Garnier, *Jules*, action of an electrical current on fused metallic sulphides, ii, 271.
Garrigou. See *C.* **Fabre**.
Garrigues, *W. E.*, the Gunning method for the estimation of nitrogen in fertilisers, ii, 328.

Garrigues, *W. E.*, estimation of potash in manures, ii, 417.
Garrod, *Archibald E.*, uroerythrin, i, 315.
—— yellow colouring matter of the urine, i, 690.
—— hæmatoporphyrin in normal urine, ii, 55.
—— pigmentation of uric acid crystals deposited from urine, ii, 55.
Gasselin, *V.*, action of boron fluoride on organic compounds, i, 451.
Gassmann, *Ch.*, and *Eugen* **Krafft**, eugenol derivatives, i, 603.
Gaud, *Fernand*, decomposition of glucose by alkalis, i, 163.
—— oxidation of alcohols by Fehling's solution: transformation of propionic into lactic acid, i, 197.
—— gravimetric estimation of glucose, ii, 92.
—— estimation of glucose by means of alkaline copper solutions, ii, 143.
Gaud, *Fernand*. See also **Allein.**
Gautier (*É. J.*) *Armand*, chlorophylls, i, 389.
Gautier, *M.* See *P. A.* **Guye.**
Gay, *Paul*, comparative digestibility of sugar beet, mangel wurzel, and distillery roots, ii, 452.
Gebbert. See **Reiniger.**
Geldard, *Julius*. See *A. G.* **Perkin.**
Genco, *A.* See *A.* **Peratoner.**
Gennari, *G.* See *G.* **Carrara.**
Genvresse, *P.*, aromatic sulphones, i, 284.
—— action of bromine on ethers in presence of sulphur, i, 317.
Georgievics, *Georg v.*, theory of dyeing, ii, 259.
Georgievics, *Georg v.*, and *Ernst* **Löwy**, theory of dyeing: distribution of methylene-blue between water and mercerised cellulose, i, 668.
Gérard, *Aimé*, estimation of tannins, ii, 335.
Gérard, *Ernest*, daturic acid, i, 331.
Gerilowski, *E.* See *A.* **Hantzsch.**
Gerlach, *Max*, behaviour of phosphoric acid soluble in water towards the absorbed constituents of soil, ii, 524.
Gerlach, *Max*, and **Süvern**, estimation of nitrogen in feeding stuffs by Kjeldahl's process, ii, 243.
Gernsheim, *Alfred*. See *A.* **Einhorn.**
Gerock, *J. E.* See *A.* **Schneegans.**
Gibbs (*O.*) *Wolcott*, complex inorganic acids, ii, 229, 274.
Giessler, *R.*, localisation of oxalic acid in plants, ii, 129.
Gillespie, *A. L.*, contents of the healthy stomach, ii, 77.
Gillespie, *A. L.*, analysis of gastric contents, ii, 77.
—— action of acids and alkalis on the gastric secretion, ii, 77.
—— gastric digestion of proteids, ii, 77.
—— albumoses in serous effusions, ii, 81.
—— hæmoglobinuria, ii, 82.
Gilpin, *Joseph E.*, orcinolsulphophthaleins, i, 184.
Gilson, *Eugen*, cell membrane of fungi, i, 323; ii, 323.
—— presence of chitin in the cellular membrane of mushrooms, ii, 408.
Gintl, *Wilhelm H.*, behaviour of calcium ethylglycollate on dry distillation, i, 334.
Giorgis, *Giovanni*, thallium hydrogen carbonate, ii, 316.
Giraud, action of sulphuric acid on charcoal, i, 229.
Gladding, *Thomas S.*, estimation of sulphur in pyrites, ii, 411.
Gladstone, *John H.*, and *Walter* **Hibbert**, the molecular refraction of dissolved salts and acids, TRANS., 831.
Glasenap, *H. W.*, decomposition and detection of cocaïne in the body in cases of poisoning, ii, 336.
Glaser, *Charles*, Kalman and Meissel's process for the volumetric estimation of phosphoric acid in superphosphates, ii, 244.
Glaser, *F.*, estimation of phosphoric acid by the citric acid process, ii, 138.
Glendinning, *Tom A.*, note on the gravimetric estimation of maltose by Fehling's solution, TRANS., 999.
Glücksmann, *Carl*, addition of hydrocyanic acid to benzaldehyde, i, 464.
—— volumetric estimation of officinal phosphoric acid, ii, 329.
—— estimation of hydrocyanic acid, ii, 538.
Glücksmann, *Carl*. See also *R.* **Přibram.**
Gmelin, *M.* See *O.* **Fischer.**
Goebbels, *Wm.*, lead double salts with organic bases, i, 390.
Göbel, *Ernst*. See *M.* **Freund.**
Goldschmidt, *Carl*, synthesis of isoquinoline, i, 72.
—— action of phosphoric anhydride on benzylideneacetoneoxime, i, 392.
—— derivatives of benzyildeneacetophenone, i, 422.
—— dichlorobenzylideneacetone, i, 529.
Goldschmidt, *Carl*. See also *E.* **Bamberger.**
Goldschmidt, *Heinrich*, isomeric diazo-derivatives, i, 661.

Goldschmidt, *Heinrich*, increase of solubility by the addition of non-electrolytes, ii, 382.

Goldschmidt, *Heinrich*, and *Ludwig* **Röder**, aldoxime salts, i, 657.

Goldschmidt, *Heinrich*. See also *J. H.* **van't Hoff.**

Goldschmiedt, *Guido*, formation of diphthalyl, i, 376.

Goldsobel, *A. G.*, constitution of ricinoleic and ricinostearolic acids, i, 81.

Goldstein, *Eugen*, action of the cathode discharge on some salts, ii, 150.

Goldstein, *I.*, addition of aromatic bases to ethereal salts of benzylidenemalic and furfurylidenemalonic acids, i, 470.

Goldstein, *Karl*. See *W.* **Wislicenus.**

Gomberg, *M.*, action of some inorganic cyanides on caffeïne, i, 628.

Gondoin, *J.*, estimation of thiocyanic acid, ii, 144.

Gonnermann, *Max*, estimation of glycocine, ii, 190.

Gooch, *Frank A.*, and *C. F.* **Clemons**, estimation of selenious acid by means of potassium permanganate, ii, 461.

Gooch, *Frank A.*, and *Charlotte* **Fairbanks**, estimation of halogens in mixtures of their silver salts, ii, 459.

Gooch, *Frank A.*, and *J.* **Howland**, iodometric estimation of telluric acid, ii, 30.

Gooch, *Frank A.*, and *H. P.* **Moseley**, detection and estimation of small quantities of arsenic in copper, ii, 31.

Gooch, *Frank A.*, and *I. K.* **Phelps**, precipitation and gravimetric estimation of carbonic anhydride, ii, 460.

Goodwin, *W.*, and *William H.* **Perkin**, jun., *cis*- and *trans*-hexahydro-orthotoluic acids, Trans., 119.

Gordon, *M. H.* See *M. S.* **Pembrey.**

Gorgeu, *Alexandre*, natural oxides of manganese, ii, 50.

Gottlieb, *Rudolf*. See *S.* **Bondzynski.**

Gouré de Villemontée, *G.*, electric potentials in a liquid conductor in uniform movement, ii, 197.

Graebe, *Carl*, nomenclature of cyclic derivatives of naphthalene, i, 106.

—— constitution of fluoresceïn, i, 182.

Graebe, *Carl*, and *Siegmund* **Levy**, condensation of toluquinone and ethylic acetoacetate, i, 225.

Graebe, *Carl*, and *P.* **Schestakow**, diphenylmethylolid (2 : 2′-hydroxydiphenylcarboxylic lactone), i, 372.

Graebe, *Carl*, and *F.* **Ullmann**, preparation of orthamidobenzophenone and synthesis of acridone, i, 147.

Grahl, *Albert*, iodo- and iodoso-isophthalic acids, i, 226.

Gramont, *Arnaud de*, spectra of selenium and natural selenides, ii, 338.

—— direct spectrum analysis of minerals and fused salts, ii, 470.

Grandval, *Alexandre*, and *Henri* **Lajoux**, senecionine and senecine, i, 632.

Granger, *A.*, action of halogen compounds of phosphorus on copper, ii, 392.

Granger, *J. Darnell*, synthesis of β-propylpiperidine, i, 480.

Grassett, *E.* See *H.* **Parenty.**

Grassi-Cristaldi, *Giuseppe*, and *G.* **Lambardi**, action of chloroform and alcoholic potash on diamines. New synthesis of benzoylglyoxaline, i, 568.

Gray, *James H.*, method for determining the thermal conductivity of metals, with applications to copper, silver, gold, and platinum, ii, 69.

Greeves, *Alfred*. See *W. P.* **Wynne.**

Gregor, *Georg*, action of methylic iodide on potassium resacetophenone, i, 43.

Gregory, *Joshua C.*, nascent state, ii, 43.

Griffiths, *Arthur B.*, red pigment of *Diemyctylus viridescens*, ii, 174.

Griffiths, *Ernest H.*, influence of temperature on the specific heat of aniline, ii, 199.

Griggi, *Gioachino*, detection of iron in commercial copper sulphate, ii, 534.

Grimaldi, *Siro*, action of carbamide on quinones, i, 425.

Grimaux, *Edouard*, action of zinc chloride on resorcinol, i, 655.

Grodspeed, *A. W.*, and *Edgar F.* **Smith**, specific heat of tungsten, ii, 199.

Gröger, *Max*, electrolytic estimation of manganese, ii, 419.

Grube, *Karl*, levulose in diabetes, ii, 520.

Grünhut, *Leo*, gravimetric estimation of sugar by means of alkaline copper solutions, ii, 91.

—— analysis of liquefied carbonic anhydride, ii, 532.

Grützner, *Bruno*, crystalline constituent of *Basanacantha spinosa var. ferox. Schum.*, ii, 408.

Grützner, *Bruno*. See also *B.* **Fischer.**

Grützner, *P.*, chemical stimulation of sensory nerves, ii, 79.

Guareschi, *Icilio*, triacetonamine, i, 327.

—— action of ethylenediamine on phorone and mesityl oxide, i, 328.

Guareschi, *Icilio*, β-cyano-γ-phenylpseudocarbostyril, i, 393.
Günter, *Heinrich*, and *Julius* **Tafel**, isomeric 2 : 5-diamidohexanes, i, 261.
Gürber, *August*, crystallisation of serum albumin, i, 255.
Guerbet, isocampholic acid, i, 61.
—— campholic acid, i, 240.
—— alkylic campholates, i, 295.
—— metallic campholates, i, 295.
—— derivatives of campholic acid, i, 383.
Guinchant, *J.*, electrical conductivity of some β-ketonic ethereal salts, i, 649.
—— preparation and conductivity of alkylic cyanomethinates, i, 649.
Gulewitsch, *W.*, cadaverine and choline from putrid horseflesh, i, 196.
Gunn, *Alexander*, new reaction illustrating dissociation, ii, 105.
Guntz, *Antoine*, demonstration of the presence of argon in the atmosphere, ii, 347.
—— acid fluorides of potassium and silver, ii, 389.
Gurcman, *A.*, electrolysis of nitrosylsulphuric acid in sulphuric acid solution, ii, 10.
Gustavson, *Gabriel*, action of chlorine on trimethylene, i, 2.
Guthzeit, *Max*, synthesis of pyridine derivatives from coumalin compounds, i, 557.
Gutzeit, *Carl*. See *A.* **Claus**.
Guye, *Phillipe A.*, critical density, ii, 6.
—— polymerisation of liquid molecules, ii, 8.
—— determination of the molecular weight of liquids, ii, 99.
—— formula of van der Waals' : log $p_c - \log p = f\mathrm{T}_c/\mathrm{T} - f$, ii, 153.
—— molecular rotation and molecular deviation, ii, 473.
Guye, *Phillipe A.*, and *Abelardo P. do* **Amaral**, optical activity of amylic derivatives in the state of liquid and of vapour, ii, 472.
Guye, *Phillipe, A.*, and *L.* **Chavanne**, ethereal salts of active amylic alcohol, i, 202.
—— —— active amylic ethereal salts and ethers, i, 317.
Guye, *Phillipe A.*, and *J.* **Fayollat**, ethereal tartrates, ii, 195.
Guye, *Phillipe A.*, and *M.* **Gautier**, superposition of the optical effects of different asymmetric carbon atoms in the same active molecule, ii, 149, 195.
Guye, *Phillipe A.*, and *John* **Jeanprêtre**, an octylic acid (ethylmethylvaleric or ethylisobutylacetic acid), i, 499.
Guye, *Phillipe A.*, and *Charles* **Jordan**, optical isomerides of α-hydroxybutyric acid, i, 333.
—— —— derivatives of active α-hydroxybutyric acid, i, 409.
—— —— active alkylic salts of the α-hydroxybutyric acids, ii, 471.
Guyot, *Alfred*. See *A.* **Haller**.

H.

Haase, *E.* See *L.* **Claisen**.
Hada, *Seihachi*, mercury and bismuth hypophosphites, Trans., 227.
Haddon, *E.* See *P.* **Cazeneuve**.
Haeussermann, *Carl*, chromium formate, i, 15.
Haeussermann, *Carl*, and *Eduard* **Martz**, ethylic dinitroterephthalate, i, 180.
Haeussermann, *Carl*, and *H.* **Teichmann**, diamidobenzoic acids, i, 531.
Haga, *Tamemasa*, and *Yūkichi* **Ōsaka**, acidimetry of hydrogen fluoride, Trans., 251.
Haga, *Tamemasa*. See also *E.* **Divers**.
Hahn, *Martin*. See *E.* **Salkowski**.
Hainlen, *Adolf*, liquid ethane and propane, i, 77.
Haiser, *Franz*, inosic acid, i, 580.
Haldane, *John S.*, physiological action of carbonic oxide, ii, 407.
Halenke, *A.*, and *W.* **Möslinger**, analysis of must and wine, ii, 463.
Hallberg, *Gustaf*, apophyllite from Grängesberg, ii, 276.
Haller, *Albin*, methenic and methinic acids : ethereal cyanacetoacetates, i, 648.
—— oxidation and nitration of benzylidenecamphor and benzylcamphor, i, 678.
—— action of phenylic isocyanate on campholic, camphocarboxylic and phthalic acids, i, 679.
Haller, *Albin*, and *Alfred* **Guyot**, phenolphthaleïn derivatives, i, 376.
—— —— diphenylanthrone, i, 671.
Haller, *Albin*, and *Jules* **Minguin**, reducing action of sodium alkoxides at high temperatures, i, 601.
Haller, *Albin*, and *Paul Th.* **Muller**, triphenylmethane colouring matters, i, 378.
Halliburton, *William D.*, nucleo-proteïds, ii, 518.
Halliburton, *William D.*, and *P. C.* **Colls**, proteoses in serous effusions, ii, 455.

Halliburton, *William D.* See also *J. W.* **Pickering.**
Hallopeau, *L. A.*, ammonium sodium hydrogen tungstates, ii, 503.
—— paratungstic acid, ii, 503.
Halphen, *Georges*, analysis of lard, ii, 146.
Halphen, *Georges.* See also *A.* **Riche.**
Hambly, *Frederick J.* See *J.* **Walker.**
Hamburger, *Carl*, comparison of the ferment actions of saliva, pancreatic juice, intestinal juice, and blood on starch paste, ii, 403.
Hamburger, *Hartog, J.*, determination of the osmotic pressures of albuminous liquids by the cryoscopic method, ii, 7.
Hampe, *Wilhelm.* See *P.* **Fernandez-Krug.**
Hanamann, *Joseph*, estimation of phosphoric acid with molybdate, ii, 530.
Hancock, *W. C.*, and *O. W.* **Dahl**, new type of ligno-celluloses, i, 493.
Handy, *James O.*, barium hydroxide solution in steel analysis, ii, 292.
Hanriot, *Maurice*, arabinochloral and xylosechloral, i, 321.
Hansen, *Adolph*, formation of substance in sea algæ, ii, 26.
Hantzsch, *Arthur R.*, formation of dyes from stereoisomeric diazo-compounds and the configuration of diazo-ethers, i, 26.
—— cause of the transformation of ethylic β-bromacetoacetate into ethylic γ-bromacetoacetate, i, 81.
—— stereoisomerism of diazo-compounds, i, 180.
—— constitution of the normal diazo-compounds and the diazo-halogen salts, i, 349.
—— isomerism of the diazosulphanilic acids and diazo-ethers, i, 369.
—— isomerism in the azo-series, i, 418.
—— diazonium compounds and normal diazo-compounds, i, 516.
—— salts of nitrosulphonic acid, ii, 75.
Hantzsch, *Arthur R.* and *H.* **Freese**, sulphur in aniline and paramidophenol: the calcium hypochlorite reaction, i, 24.
Hantzsch, *Arthur R.*, and *D.* **Gerilowski**, diazosulphanilic acid and its stereoisomeric salts, i, 664.
Hantzsch, *Arthur R.*, and *A.* **Lucas**, symmetrical trimethylbenzaldoxime, i, 356.
Hantzsch, *Arthur R.*, and *Ludwig* **Mai**, phenylimidocarbonates, i, 415.
Hantzsch, *Arthur R.*, and *Otto W.* **Schulze**, stereoisomeric diazocyanides, i, 348.
—— —— derivatives of the benzenediazocarboxylic acids, i, 658.
Hantzsch, *Arthur R.*, and *J.* **Urbahn**, hydroxamic acids and hydroxyfurfurazane derivatives, i, 393.
Hardine, *D.* See **Lagodzinski.**
Hardy, *W. B.* See *R. F.* **D'Arcy.**
Harley, *Vaughan*, influence of intravenous injection of dextrose on the gases of the blood, ii, 76.
—— absorption of fat, ii, 320.
—— absorption and metabolism in the obstruction of the pancreatic duct, ii, 454.
Harries, *Carl D.*, asymmetrical ethylic phenylhydrazidoacetate and its conversion into triazine derivatives, i, 459.
Harries, *Carl D.*, and *George J.* **Busse**, dihydromethylcoumaran, i, 279.
Harries, *Carl D.*, and *E.* **Klamt**, methanehydrazomethane, i, 262.
Harris, *D. F.*, coagulation of milk, ii, 122.
Harris, *Vincent D.*, mycological processes in the intestines, ii, 453.
Hartley, *W. Noel*, variations observed in the spectra of carbon electrodes, ii, 432.
—— flame spectra at high temperatures. Spectrum of metallic manganese, of alloys of manganese, and of compounds containing that element, ii, 432.
—— flame spectra at high temperatures. The spectroscopic phenomena and thermochemistry of the Bessemer process, ii, 432.
Haselhoff, *Emil*, estimation of nitrogen in guano, ii, 138.
Haussmann, *Emil*, action of ethylamine on ethylic 6-ethoxycoumalin-3 : 5-dicarboxylate, i, 557.
Haworth, *E.*, and *William H.* **Perkin**, jun., phenylethers of methylene and ethylene-glycols. Synthesis of α-methylbutyrolactone, PROC., **1895**, 40.
Hayduck, *Michael M.*, hop tannin and phlobaphene, i, 470.
Hayem, *Georges*, fibrinogen and fibrin, ii, 234.
Haymann, *K.* See *K.* **Auwers.**
Heberlein, *Georg.* See *H.* **Rupe.**
Hébert, *Alexandre.* See *H.* **Lecomte.**
Heddle, *M. Forster*, and *J. Stuart* **Thomson**, delessite from Cantyre, ii, 512.

Hedin, *Sven G.*, a new decomposition product of keratin, i, 160.
—— determination of isosmotic concentrations, ii, 381.
Heffter, *Arthur*, two cactus alkaloïds, i, 120.
Heffter, *Werner*, anthrathiol and derivatives of anthracene-β-sulphonic acid, i, 671.
Hehner, *Otto*, gravimetric estimation of the bromine absorption of fats, ii, 428.
Hehner, *Otto*, and *Charles A.* **Mitchell**, new thermal method for examining oils, ii, 427.
Heidenreich, *Karl*. See *T.* **Curtius.**
Heilbronner, *M.*, iodonium bases from 1 : 2-iodotoluene, i, 529.
Heinebuch, *A.*, analysis of urine, ii, 143.
Helbig, *D.*, oxidation of naphthalene tetrachloride, i, 291.
Hell, *Carl*, anethoïl, i, 341.
—— derivatives of eugenol, i, 656.
Hell, *Carl*, and *G.* **Gärttner**, action of bromine on anethoïl, i, 341.
Hell, *Carl*, and *B.* **Portmann**, derivatives of isoeugenol, i, 657.
Heller, *Gustav*, constitution of fluoresceïn and eosin, i, 234.
Heller, *Hans*, derivatives of amidoaldehyde, i, 89.
Hellich, *A.*, assay of nitre, ii, 87.
Hempel, *Hans*. See *M.* **Freund.**
Henderson, *George G.*, and *A. R.* **Ewing**, action of certain acidic oxides on salts of hydroxy-acids. Part I. Metallic tartrarsenites, Trans., 102.
Henderson, *George G.*, and *David* **Prentice**, the action of certain acidic oxides on salts of hydroxy-acids. Part II. Trans., 1030.
Henderson, *James*. See *P. F.* **Frankland**, *J.* **Walker.**
Henke, *F.* See *J.* **Volhard.**
Henriques, *Robert*, thio-derivatives of β-naphthol, i, 103, 237.
—— analysis of indiarubber, ii, 96, 191.
Henry, *Louis*, action of halogen hydracids on formaldehyde in presence of alcohols, i, 80.
—— ethylenemethylal, i, 266.
—— methylenic lactate, i, 332.
—— aldehydes of the acetic series, i, 446.
—— nitro-alcohols, i, 637.
Hepp, *Eduard*. See *O.* **Fischer.**
Herde, *Jos.* See *F.* **Heusler.**
Herre, *Alfred*, thionyl compounds of some aromatic ethylic salts, i, 365.
Herty, *Charles H.*, mixed double haloïds of antimony and potassium, ii, 113.
Herzfeld, *Alexander*, specific rotatory power of acetylmaltose and of maltose, i, 260.
Herzfelder, *Armand*, the interaction of sulphur and α-nitronaphthalene, Trans., 640.
Herzig, *Josef*, quercetin derivatives, i, 387, 554.
Herzig, *Josef*, and *Hans* **Meyer**, detection and estimation of alkyl groups attached to nitrogen, ii, 296.
Herzig, *Josef*, and *J.* **Pollak**, action of alkalis on brominated derivatives of phloroglucinol, i, 343.
Hess, *W.*, estimation of iron and aluminium in phosphates, ii, 246.
Hesse, *Oswald*, crystalline constituents of true Coto bark, i, 110.
—— opium alkaloïds, i, 117.
—— reuniol, i, 186.
—— chrysophanic acid, i, 292.
—— compounds from lichens, i, 298.
—— Pereiro bark, i, 312.
—— quinine alkaloïds, i, 579.
—— hydrocinchonine, hydrochlorocinchonine, and hydrochlorapocinchonine, i, 630.
Heuck, *R.*, condensation of aromatic aldehydes with cyanacetamide, malonamide, and malononitrile, i, 651.
—— nitrofurfur-derivatives, i, 651.
Heusler, *Friedrich*, brown-coal tar, i, 258.
—— formation of normal alkylic sulphates when tar oils are washed with sulphuric acid, i, 258.
—— estimation of sulphur in petroleum, ii, 412.
Heusler, *Friedrich*, and *Jos.* **Herde**, estimation of paraffin in crude anthracene, ii, 423.
Hewitt, *John T.*, halogen benzeneazophenols, i, 353.
Heycock, *Charles T.*, and *Francis H.* **Neville**, on the determination of high temperatures by means of platinum resistance pyrometers, Trans., 160.
—— —— on the freezing points of gold and silver, Trans., 1024.
Heyl, *Georg*, and *Victor* **Meyer**, synthesis of unsaturated aromatic acids, i, 542.
Hibbard, *P. L.*, estimation of starch, ii, 426.
Hibbert, *Walter*. See *J. H.* **Gladstone.**
Hibbs, *Joseph G.*, and *Edgar F.* **Smith**, action of magnesium on manganous salts, ii, 316.
Higley, *George O.*, action of nitric acid on metals, ii, 164.
Hilgard, *Eugen W.*, and *Mejer E.*

Jaffa, amount of nitrogen in the humus in soils of arid and humid regions, ii, 367.

Hilger, *Albert*, and *A.* **Eminger**, estimation of theobromine in cocoa-nibs and cocoa, ii, 542.

Hill, *Leonard*, simple form of gas pump, ii, 51.

Hill, *Leonard*, and *D. N.* **Nabarro**, blood gases of brain and muscle in rest and activity, ii, 231.

—— —— exchange of blood gases in brain and muscle, ii, 405.

Hiltner, *Lorenz*, influence of the root nodules of *Alnus glutinosa* on the fixation of nitrogen, ii, 522.

Himmelbauer, *R.*, pyrazolone derivatives, i, 570.

Hinman, *B. C.*, orthoclase from Canada, ii, 23.

Hinsberg, *Oscar*, diphenylsulphone derivatives, i, 144.

—— derivatives of diphenylsulphone and of phenylnaphthylsulphone, i, 471.

Hinsberg, *Oscar*, and *J.* **Rosenzweig**, synthesis of derivatives of indole and glycocine, i, 144.

Hintz, *E.* See *C. R.* **Fresenius.**

Hirst, *Henry R.*, and *Julius B.* **Cohen**, a modification of Zincke's reaction, Trans., 826.

—— —— a method for preparing the formyl derivatives of the aromatic amines, Trans., 829.

Hite, *H. B.*, boiling point apparatus for molecular weight determinations, ii, 479.

Hjelt, *Edvard I.*, constitution of the alkali compounds of phenolphthaleïn, i, 99.

—— velocity of coumarin formation, i, 140.

Hjelt, *Edvard I.* See also *O.* **Aschan.**

Hobbs, *William H.*, vulcanite, a new rock, ii, 277.

Hodgkinson, *William R.*, and *N. E.* **Bellairs**, oxidising action of ammonia solution on some metals, Proc., **1895**, 9.

—— —— note on some reactions of ammonium salts, i, 114.

Hodgkinson, *William R.*, and *Arthur H.* **Coote**, action of magnesium on some phenylhydrazine compounds, Proc., **1895**, 9.

Hofacker, *E.*, and *Eduard A.* **Kehrer**, dibasic ketonic acid, $C_{10}H_{14}O_6$, i, 334.

Hoff, *Jacobus H. Van't*, products formed in the slow oxidation of phosphorus, ii, 262.

Hoff, *Jacobus H. Van't*, and *Heinrich* **Goldschmidt**, Wyrouboff's racemate, ii, 485.

Hoff, *Jacobus H. van't*, *Heinrich* **Goldschmidt**, and *W. P.* **Jorissen**, transition temperatures of some racemates, ii, 380.

Hoffman, *G. Christian*, native iron, ii, 20.

Hoffmann, *Theodor.* See *R.* **Fittig.**

Hofmann, *Karl A.*, thioaniline (m. p. 105°), and a new isomeride, i, 87.

—— new modes for formation of thiodiphenylamine, i, 132.

Hofmann, *Karl A.*, and *O. F.* **Wiede**, new nitroso-compounds of iron, ii, 317, 451.

Hofmann, *W.* See *O.* **Fischer.**

Hogg, *Thomas W.*, occurrence of titanium cyanonitride in ferromanganese, i, 487.

Hoitsema, C., absorption of hydrogen by palladium, ii, 388.

Holde, *D.*, simple substitute for a separating funnel, ii, 162.

—— sunflower oil, ii, 335.

Holland. See **Lindsey.**

Holleman, *Arnold F.*, phenylnitromethane, i, 455.

—— acid benzylamine oxalate, i, 457.

—— benzophenoneoxime, i, 475.

—— spontaneous decomposition of thiosulphuric acid, ii, 493.

Holleman, *Arnold F.*, and *A. C.* **Antusch**, solubility of solid non-electrolytes in mixtures of alcohol and water, ii, 156.

Holmquist, *P. J.*, pyrochlore from Alnö, Sweden, ii, 509.

Holst, *H.* See *K.* **Prytz.**

Hoppe-Seyler, (*E. I.*) *Felix*, chitin and cellulose, i, 166.

—— decomposition of chitin, i, 167.

Hoppe-Seyler, (*E. J.*) *Felix* and *Trasaburo* **Araki**, rotatory action of lactates, ii, 174.

Horne, *W. D.*, analysis of bone-black, ii, 416.

Horst, *Fritz.* See *M.* **Freund.**

Hosaeus, *Hans.* See *A.* **Koch.**

Hovey, *Edmund O.*, the cherts of Missouri, ii, 118.

Howland, *J.* See *F. A.* **Gooch.**

Hübner (*H. J. A.*) *Eduard*, behaviour of the calcium salts of alkyl derivatives of aromatic acids on dry distillation, i, 366.

Hütz, *Hugo.* See *E.* **Fischer.**

Hugounenq, *Louis*, estimation of potassium sulphate in wine, ii, 418.

Hummel, *John J.* See *A. G.* **Perkin.**

Hundeshagen, *Franz*, applications of alkalimetry and acidimetry, ii, 84.

Hunter, *William*, physiological action of tolylenediamine, ii, 456.

Hussak, *Eugen*, and *George T.* **Prior**, lewisite and zirkelite, two new Brazilian minerals, ii, 508.

Huysse, *A. C.*, colorimetric estimation of hydrogen sulphide, ii, 289.

I.

Igelström, *Lars J.*, lindesite and pyrhoarsenite, ii, 76.

—— thallium and molybdenum in hæmatite, ii, 505.

Ilosvay de Nagy Ilosva, *Ludwig*, secondary products containing nitrogen formed during combustion in air, ii, 61.

—— bye-products formed in the interaction of azone and ammonia, ii, 74.

—— mutual behaviour of hydrogen peroxide and nitrous acid, ii, 496.

—— new reaction of hydrogen peroxide, ii, 526.

Imgart, *Hans*. See *M.* **Freund**.

Ince, *Walter H.*, preparation of adipic acid and some of its derivatives, TRANS., 155.

Ingle, *Harry*, and *Harold H.* **Mann**, stereoisomeric osazones. Part 1. TRANS., 606.

Ingle, *Harry*. See also *F. D.* **Chattaway**.

Ishii, *J.*, mannan as a reserve material in the seeds of *Diospyrus kaki*, ii, 128.

—— mucin in plants, ii, 128.

Iwanowsky, *D.*, effect of oxygen on alcoholic fermentation, ii, 282.

J.

Jackson, *C. Loring*, and *F. B.* **Gallivan**, derivatives of unsymmetrical tribromobenzene, i, 212.

Jackson, *C. Loring*, and *George* **Oenslager**, constitution of phenoquinone, i, 513.

Jacobson, *Paul*, and *P.* **Piepenbrink**, reduction products of azo-compounds, i, 26.

Jaegle, *Georg*. See *E.* **Besthorn**, *W.* **Koenigs**.

Jaffa, *Mejer E.* See *E. W.* **Hilgard**.

Jagerspacher, *C.*, formazyl compounds, i, 573.

Jahn, *Hans*, calculation of the heat of dissolution, ii, 484.

Jahn, *Hans*, and *Otto* **Schönrock**, thermodynamics of galvanic polarisation, ii, 198.

Jahn, *Hans*, and *E.* **Schröder**, the relation between dissociation and temperature, ii, 203.

Jakimowicz, *Piotr*, preparation of thymolphthalide, i, 602.

Jaksch, *Rudolph v.*, amount of nitrogen in red blood crystals in health and disease, ii, 24.

Jannasch, *Paul*, separation of arsenic, tin, or antimony from lead, copper, silver, cobalt, nickel, &c., ii, 89.

—— decomposition of silicates by pure lead carbonate, ii, 330.

Jannasch, *Paul*, and *E. v.* **Cloedt**, separation of bismuth, lead, and manganese from mercury by means of hydrogen peroxide, ii, 332.

Jannasch, *Paul*, and *H.* **Kammerer**, quantitative analysis of galena, ii, 418.

—— —— separation of metals in alkaline solution by means of hydrogen peroxide, ii, 423.

Jannasch, *Paul*, and *James* **Locke**, apatite in a laminated graphite from Ceylon, ii, 22.

—— —— analysis of apatite in a laminated graphite from Ceylon, ii, 31.

Jannasch, *Paul*, *Eduard* **Rose**, and *Robert* **Niederhofheim**, separation of metals with a current of carbonic anhydride containing bromine, ii, 422.

Jannasch, *Paul*, and *A.* **Röttgen**, quantitative separation of metals in alkaline solution with hydrogen peroxide, ii, 331.

—— —— estimation of fluorine, ii, 460.

Jannasch, *Paul*, and *F.* **Schmitt**, separation of metals in a current of hydrogen chloride, ii, 462.

Jannasch, *Paul*, and *Max* **Weiler**, derivatives of isodurene, i, 130.

—— —— oxidation products of isodurene, i, 283.

Jannasch, *Paul*, and *P.* **Weingarten**, chemical composition and constitution of vesuvians, ii, 319.

—— —— estimation of water in silicates, ii, 325.

Jannasch, *Paul*, and *J. H.* **Wigner**, 2 : 4 : 6-trimethylethylbenzene, i, 655.

Jannettaz, *Edouard*, analysis of pyreneite, ii, 401.

Japp, *Francis R.*, and *W. B.* **Davidson**, interaction of 1 : 2-diketones with primary amines of the general formula, $R\cdot CH_2\cdot NH_2$, TRANS., 32.

—— —— condensation of benzile with ethylic malonate, TRANS., 132.

Japp, *Francis R.*, and *G. Druce* **Lander**, condensation of benzile with ethylic acetoacetate, PROC., 1895, 146.

Jarry, *R.* See *P.* **Villard.**

Jaubert, *George F.*, constitution of the safranines, i, 219, 278.

—— derivatives of naphthalic acid, i, 239.

—— phenolnaphthaleïn, i, 425.

—— nitro- and amido-derivatives of paraditolylamine, i, 514.

—— relation of the safranines to the mauveines and indulines, i, 527.

Jaworowski, *A.*, detection of glucose, ii, 334.

Jean, *Ferdinand*, estimation of iron and aluminium in phosphates, ii, 246.

Jeanprêtre, *John.* See *P. A.* **Guye.**

Jedermann, *Robert*, examination of rose oil for geranium oil, ii, 187.

Jeiteles, *Berthold*, cyanide and carboxylic acid derived from isoquinoline, i, 393.

Jensch, *Edmund*, analysis of zinc ores, ii, 139.

Jerome, *William J. S.*, abnormal excretion of sulphur in a dog, ii, 362.

Joannis, (*J.*) *Alexandre*, action of hydrogen phosphide on potassammonium and sodammonium, ii, 75.

Jörgensen, *Sofus M.*, constitution of cobalt, chromium, and rhodium bases, ii, 47.

Johanny, *Gustav*, action of hydrocyanic acid on unsaturated aldehydes, i, 16.

John, *W.* See *E. P.* **Perman.**

Johnson, *Frank*, estimation of sulphur in pyrites, ii, 63.

Jolles, *Adolf*, detection of iodine in urine, ii, 136.

—— detection of bile pigment in urine, ii, 336.

Joly, *Alexandre*, and *Émile* **Leidié**, action of heat on iridium potassium nitrites, ii, 503.

Joly, *John*, specific heats of gases at constant volume. Parts II and III. Carbonic anhydride, ii, 69.

Jonas, *Oscar.* See *O.* **Fischer.**

Jones, *Harry C.*, lowering of the freezing point, ii, 7.

—— atomic weight of yttrium, ii, 269.

—— estimation of formic acid by potassium permanganate, ii, 463.

Jordan, *Charles.* See *P. A.* **Guye.**

Jorissen, *W. J.*, and *E. van de* **Stadt**, heat of combination of water of crystallisation of organic compounds, ii, 202.

Jorissen, *W. P.* See *J. H. van't* **Hoff.**

Jovitschitsch, *Milorad*, oxidation of ethylic isonitrosoacetoacetate with nitric acid, i, 447.

Jovitschitsch, *Milorad*, nitromethylisoxazolone, i, 684.

Jowett, *Hooper A. D.* See *W. R.* **Dunstan.**

Jüptner, *Hanns v.*, estimation of phosphoric acid by means of ammonium molybdate, ii, 414.

—— estimation of iron in ores, slags, &c.. ii, 420.

—— Eggertz's phosphorus test, ii, 530.

Juillard, *Paul*, turkey-red oil, i, 82.

—— triricinoleïn, i, 500.

—— natural dihydroxystearic acid, i, 500.

Jungfleisch (*C.*) *Émile* and *Eugène* **Leger**, β-hydroxycinchonine, i, 310.

—— —— cinchonigine, i, 404.

Junius, *Ernst.* See *E.* **Fromm.**

K.

Kärsten, *W.* See *C. A. A.* **Michaelis.**

Kahlbaum, *Georg W. A.*, apparatus for fractional distillation under very low pressures, ii, 215.

—— simple centrifugal apparatus, ii, 216.

—— determination of boiling points by the dynamical method, ii, 379.

Kahlbaum, *Georg W. A.*, and *C. G. v.* **Wirkner**, Dühring's law of corresponding boiling points, ii, 37, 70.

Kaiser, *E* See *E. A. H.* **Laspeyres.**

Kalecsinszky, *Alexandre v.*, preservation of chemically pure alkaline solutions, ii, 108.

Kalischer, *Georg*, preparation of diamidoacetone, i, 496.

—— constitution of isonitroso-ketones, i, 498.

Kalman, *S.* See *J.* **Spüller.**

Kalmann, *Wilhelm*, and *K.* **Meissels**, volumetric estimation of the soluble phosphoric acid in superphosphates, ii, 290.

Kammerer, *H.* See *P.* **Jannasch.**

Karcz, *Marcell*, estimation of crystallisable sugar in raw sugars, ii, 93.

Karsch, *W.* See *J.* **König.**

Kassner, *Georg*, orthoplumbates of the alkaline earths, ii, 14.

Kastle, *J. H.*, and *B. C.* **Keiser**, diazobenzene aniline chloride, i, 275.

—— —— determination of the affinities of acids colorimetrically by means of potassium dichromate, ii, 386.

Kastle, *J. H.*, and *Paul* **Murril**, hydrolysis of ethereal salts of sulphonic acids by alcohols, i, 370.

Katzer, *Friedrich,* tourmalin, gypsum, and other minerals from Bohemia, ii, 277.

Kaufmann, *Ludwig.* See *H.* **Wislicenus.**

Kaufmann, *Maurice,* glycogen in the blood, ii, 233.

—— urea in arterial and venous blood, ii, 236.

Kauschke, *P.*, action of bromine on phenylic salicylate phenylic benzoate, and ortho-, para-, and meta-cresylic benzoates and guaiacol benzoate, i, 280.

Kayser, *R.*, relation of fat and carbohydrates to the decomposition of albumin in the human body, ii, 404.

Kehrer, *Eduard A.* See *E.* **Hofacker.**

Kehrmann, *Friedrich,* constitution of fluorindines and rosindulines, i, 148, 526.

—— quinoneamides and amidoquinones, i, 151.

—— action of orthamidophenol on orthodiketones, i, 214.

—— stereoisomeric derivatives of quinonedioximes, i, 217.

—— oxazines of the naphthalene series, i, 245.

—— action of alcoholic ammonium sulphide on 1 : 2 : 4-amidodinitrobenzene, i, 514.

—— constitution of the fluorindines, i, 526.

—— relation of indulines to safranines, i, 527.

Kehrmann, *Friedrich,* and *E.* **Böhm,** complex inorganic acids: phosphoduodecimolybdic acid and phospholuteomolybdic acid, ii, 112.

Kehrmann, *Friedrich,* and *B.* **Mascioni,** derivatives of iodohydroxynaphthaquinone (iodonaphthalic acid), i, 237.

Kehrmann, *Friedrich,* and *M.* **Tikhvinsky,** nitrotoluquinol, i, 513.

Keiser, *B. C.* See *J. H.* **Kastle.**

Keiser, *Edward H.*, and *Mary B.* **Breed,** action of magnesium on the vapours of alcohols: preparation of allylene, i, 405.

Keiser, *K.*, orthosubstitution products in the thiophen series, i, 508.

Kellas, *Alexander M.* See *G. W.* **Macdonald.**

Keller, *Harry F.*, analysis of American refined copper, ii, 186.

Kemp, *George T.*, estimation of nitrous oxide, ii, 328.

Kerp, *Wilhelm,* reducing action of alcohol at high temperatures, i, 538.

Kerry, *Richard.* See *F.* **Obermayer.**

Kiefer, *H. E.* See *W. B.* **Schober.**

Kilgore, *B. W.*, estimation of phosphoric acid by titrating the yellow precipitate, ii, 183.

—— estimation of phosphoric acid by the molybdate process, ii, 329.

Kiliani, *Heinrich,* maltol, i, 164.

Kiliani, *Heinrich,* and *M.* **Bazlen,** digitogenin derivatives, i, 65.

—— —— maltol, i, 80.

Killing, *C.*, testing butter for foreign fats, ii, 145.

Kippenberger, *Carl,* simple apparatus for gas analysis, ii, 242.

—— examination of decomposed human bodies for alkaloïds and glucosides, ii, 465.

Kipping, *F. Stanley,* stereoisomeric $\alpha\alpha'$-dimethylpimelic acids, TRANS., 139.

—— dimethylketohexamethylene, TRANS., 349.

—— bromocamphoric acid, an oxidation product of π-dibromocamphor, PROC., **1895**, 33.

—— derivatives of π-bromocamphoric acid, PROC., **1895**, 88.

Kipping, *F. Stanley* and *William J.* **Pope,** sulphonic derivatives of camphor, TRANS., 354.

—— —— π-halogen derivatives of camphor, TRANS., 371.

—— —— the melting points of racemic modifications and of optically active isomerides, PROC., **1895**, 39.

—— —— new isomeric sulphonic chlorides derived from camphor, PROC., **1895**, 57.

Kipping, *F. Stanley,* and *O. F.* **Russell,** paraheptotoluene and its derivatives, TRANS., 502.

Kirchhoff, *H.*, disubstituted succinic acids, i, 20.

Kirpal, *Alfred.* See *E.* **Bamberger.**

Kitschelt, *Max.* See *E.* **Bamberger.**

Kitt, *Moritz,* dimethylthiophen (thioxen), i, 509.

Klages, *A.*, and *Emil* **Knoevenagel,** synthesis of metachlorotoluene and of symmetrical chloro-xylene from ethylic acetoacetate, i, 86.

—— —— 5-chlorodihydrometaxylene, i, 654.

Klamt, *E.* See *C. D.* **Harries.**

Klason, *(J.) Peter,* platinum compounds of ethylic sulphide, i, 488.

—— platosodiammoniodipyridine compounds, i, 557.

—— constitution of the platinum bases, ii, 400.

Kleber, *Clemens.* See *F. B.* **Power.**

Klein, *A.* See *A.* **Werner.**

Klemptner, *Max*, action of copper on the animal organism, ii, 321.
Klimont, *J.*, assay of ethereal oils, ii, 91.
Klingenstein, *E.*, ethylglyoxalidine and propylglyoxalidine, i, 481.
Klug, *Ferdinand*, peptic digestion, ii, 232.
Kluge, *Fritz*, preparation of the paraffins, i, 77.
Knieder, colorimetric assay of cobalt ores, ii, 534.
Knietsch, *Rudolf*, the critical temperature as a criterion of chemical purity, ii, 304.
Knobloch, *J.*, new volumetric methods, ii, 326.
Knoevenagel, *Emil*, 1 : 5-diketones, i, 48.
—— preparation of anhydrous diazo-salts, i, 669.
Knoevenagel, *Emil*. See also *A.* **Klages.**
Knoll, *R. J.*, and *Paul* **Cohn,** orthobromophenyl naphthyl ketone, i, 477.
—— —— naphthylindoxazen, i, 619.
Knorr, *Ludwig*, constitution of the phenylpyrazoles, i, 395.
—— condensation of benzoylaldehyde with hydrazine, i, 395.
—— formation of 4-phenylpyrazole, i, 396.
—— constitution of phenylpyrazolone, i, 396.
—— derivatives of the phenol-form of 3 : 1-ethylphenyl-5-pyrazolone, i, 396.
—— aromatic character of the pyrazoles, i, 397.
Knox, *W. F.*, conductivity of aqueous solutions of carbonic anhydride, ii, 100.
Knudsen, *Peter*, substituted amido-derivatives of aldehydecollidine, i, 562.
—— derivatives of picoline-α-lactic acid, i, 563.
Kny, *L.*, physiological meaning of the cyanic colouring matters, ii, 27.
Koch, *Alfred*, and *Hans* **Hosaeus,** behaviour of yeast towards glycogen, ii, 322.
Koch, *A.*, and *P.* **Kossowitsch,** assimilation of nitrogen by algæ, ii, 58.
Koch, *F.*, mid European nut galls and *Scrophularia nodosa*, L., ii, 409.
Koch, *H.*, estimation of carbon in steel, ii, 86.
Koch, *P.* See *R.* **Möhlau.**
Kock, *Karl*. See *H.* **Eckenroth.**
Köhler, *A.*, *F.* **Barnstein,** and *W.* **Zielstorff,** Kuhn's method of artificial digestion of nitrogenous food constituents by pepsin solution, ii, 516.
Koehne, *Fr.*, behaviour of acid imides in the animal organism, ii, 280.
König, (*F.*) *Josef*, and *W.* **Karsch,** ratio of *d*-glucose to levulose in sweet wines and honey. Use of this ratio for detecting adulteration, ii, 188.
Koenigs, *Wilhelm*, and *Georg* **Jaeglé,** paramethoxy-γ-phenylquinaldine. New synthesis of γ-phenylquinaldinic acid, i, 431.
Koenigs, *Wilhelm*, and *Franz* **Meimberg,** derivatives of γ-phenylquinaldine and γ-phenylquinoline, i, 431.
Koenigs, *Wilhelm*, and *Carl* **Meyer,** sulphocamphylic acid, i, 154.
Köppe, *H.*, new method for the determination of isosmotic concentrations, ii, 208, 488.
Körner, *W.* See *W.* **Korner.**
Kohler, *E. P.* See *I.* **Remsen.**
Kohlmann, *W.*, cassiterite, ii, 275.
Kohlrausch, *Friedrich*, determination of the resistance of electrolytes, ii, 35.
Kohn, *Emil*, derivatives of galactonic acid, i, 504.
Komppa, *Gustav*, constitution of coumarone, i, 533.
Kondakoff, *Ivan*, some derivatives of menthol and of menthene, i, 549.
Konek *v.* **Norwall,** *Fr.*, reduction of cinchonine, i, 579, 688.
—— action of sodium and amylic alcohol on cinchonine, i, 631.
Koninck, *Lucien L. de*, properties of nickel and cobalt salts, ii, 355.
—— estimation of sulphur in iron, ii, 528.
Koninck, *Lucien L. de*, and *Ed.* **Nihoul,** estimation of organic sulphur, ii, 136.
Koningh, *Leonard de*, estimation of arsenic and sulphur, ii, 184.
Konovaloff, *Michaël*, action of nitric acid on saturated hydrocarbons and their derivatives, i, 633.
—— reaction for primary and secondary nitro-compounds, i, 634.
Konovaloff, *Michaël*. See also *F.* **Markovnikoff.**
Kopisch, *Friedrich*, hydroxy-derivatives of phenylbutyric acid, i, 92.
Korda, *Désiré*, thermochemical carbon battery, ii, 302.
Korkunoff, *Alexander*. See *E.* **Voit.**
Korner, *W.*, preparation of orthodibromaniline, i, 594.
Korner, *W.*, and *Angelo* **Menozzi,** action of methylic iodide on dimethylasparagine, i, 591.

Kortright, *Frederick L.*, effect of hydrolysis on reaction velocities, ii, 159.

Kortright, *Frederick L.* See also *J.* **Trevor.**

Kosmann, *K.*, kammererite from Tampadel, in Silesia, ii, 172.

Kossel, *Albrecht C. L. M. L.*, and *H.* **Schmied**, estimation of urea in urine, ii, 541.

Kossowitsch, *P.*, fixation of free nitrogen by algæ, ii, 59.

Kossowitsch, *P.* See also *A.* **Koch.**

Kozireff, *D.* See *S.* **Tanatar.**

Krafft, *Eugen.* See *C.* **Gassmann.**

Kramm, *William*, physiological action of hydrohydrastinium hydrochloride, ii, 362.

Kratschmer, *Florian*, and *E.* **Wiener**, estimation of carbonic anhydride in air, ii, 32.

Krauss, *C.*, and *August* **Stellwaag**, effect of the ripeness and of manures on the physical and chemical properties of barley meal, ii, 61.

Kraut, *Karl*, ammonium orthophosphate, ii, 109.

Kreichgauer, *Andreas*, estimation of lead, ii, 418.

Kreider, *D. Albert*, preparation of perchloric acid and its use in the estimation of potassium, ii, 444.

Kreis, *Hans*, detection of earth nut oil, ii, 540.

Krenner, *József A.*, andorite, a new Hungarian silver ore, ii, 21.

Kröber, *E.* See *C. J.* **Lintner.**

Kronthal, *W.* See *L.* **Rugheimer.**

Krüger, *Friedrich*, and *Wilhelm* **Lenz**, calcium in the liver cells of the ox, ii, 53.

Krüger, *Friedrich*, *F.* **Szymkiewicz**, *L. v.* **Lingen**, and *H.* **Walter**, sulphur and phosphorus in the hepatic and splenic cells at different ages, ii, 54.

Krüger, *Martin*, separation of uric acid, adenine, and hypoxanthine, ii, 94.

—— precipitation of uric acid and xanthine derivatives, ii, 373.

Krüger, *Martin*, and *C.* **Wulff**, estimation of xanthine-like substances in urine, ii, 94.

Krüger, *Paul.* See *F.* **Tiemann.**

Krümmel, *Hans*, action of halogens and thiocarbonyl dichloride on amidoximes, i, 661.

Krüss, *Gerhard*, and *Oskar* **Ungar**, dichromates of the heavy metals, ii, 355.

Kühling, *Otto*, action of acid chlorides on sodium paranitrophenylnitrosamine, i, 182.

Kühling, *Otto*, displacement of isodiazo-groups by cyclic radicles, i, 290.

—— oxidation of tolualloxazine, i, 688.

Kühn, *Carl*, formation of veratric acid from hemipinic acid, i, 367.

Kühn, *Julius*, utilisation of the nitrogen of farmyard manure and of green manure, ii, 367.

Kühn, *M.*, the keeping of milk for analysis, ii, 189.

—— analysis of cheese, ii, 539.

Kühne, *Willie*, visual purple, ii, 361.

Külz, *C.*, paralactic acid in normal pericardial fluid, ii, 405.

Külz (*R.*) *Eduard*, gases of human milk, ii, 405.

Külz (*R.*) *Eduard*, and *J.* **Vogel**, pentoses in diabetic urines, ii, 406.

Künne, *Hermann*, aliphatic amidoketones, i, 685.

Kürsten, *Rudolf.* See *J.* **Bertram.**

Küster, *Fritz W.*, blue iodide of starch and the molecular structure of "dissolved starch," i, 199.

—— the blue iodide of cholic acid, i, 313, 322.

—— blue iodine compounds of starch and cholic acid, i, 322.

—— melting points of mixtures of isomorphous salts, ii, 36.

—— isomorphous mixtures, ii, 257.

—— estimation of halogens by Carius' method: application of Volhard's modification, ii, 411.

—— molecular weight determinations in solid solutions, ii, 439.

Kuhlmann, *Fritz.* See *C. A. A.* **Michaelis.**

Kulisch, *Victor*, condensation of orthotoluidine with α-diketones and with the salts of α-ketonic acids, i, 666.

Kunckell, *Franz*, some selenium derivatives of anisoïl and phenetoïl, i, 341.

Kuntze, *O.* See *W.* **Muthmann.**

Kunz-Krause, *H.*, emetine, i, 118.

Kurnakoff, *Nicolai S.*, complex metallic bases, i, 199,

—— constitution of metallic bases, ii, 499.

Kutusow, *L.*, colorimetric estimation of picric acid in its compounds with organic bases, ii, 64.

Kym, *Otto*, new formation of secondary amines, i, 292.

L.

Laar, *J. J. van*, correct formulæ for osmatic pressure, change of solubility; melting and boiling point; heat of solution and dilution in dissolved dissociated substances, ii, 107.

Laar, *J. J. van*, calculation of the heat of dissolution, ii, 484.
Laas, *Rudolf*, influence of fats on assimilation of proteids, ii, 78.
Lachowicz, *Bronislaw*, action of aniline bases on benzoïn, i, 46.
Lackschewitz, *Th.*, estimation of blood corpuscles, ii, 122.
Ladenburg, *Albert*, methylglyoxalidine or lysidine, i, 73.
—— pure dextrorotatory conine, i, 115.
—— *r*-coniïne, i, 253.
—— resolution of pyrotartaric acid into its optically active components, i, 499.
—— *ν*-methyltetrahydroquinoline (kairoline) and tetrahydroquinoline methoxide, i, 480.
—— racemism and changes of temperature on mixing liquids, ii, 485.
—— molecular symmetry and asymmetry, ii, 489.
Ladenburg, *Albert*, and *Max* **Scholtz**, synthesis of piperic acid and piperine, i, 42.
Lafon, *Ph.*, apparent presence of sugar in the urine of persons taking sulphonal, ii, 406.
Lagodzinski, *Kasimir*, synthesis of quinazarin and hystazarin, i, 232.
—— 2 : 3-dihydroxyanthracene, i, 544.
—— constitution of β-anthraquinone, i, 544.
—— synthesis of alizarin from hemipinic acid, 545.
Lagodzinski, *Kasimir*, and *D.* **Hardine**, preparation of 1 : 2-naphthaquinone, i, 105.
—— —— 1 : 2-dihydroxynaphtho-3 : 4-acridone, i, 107.
Lagorio, *Alexander E.*, pyrogenetic corundum, ii, 276.
Laguardia, *Pietro*, toxicological investigation of potassium silicate, ii, 237.
Lajoux, *Henri*. See *Alexandre* **Grandval**.
Lamal, new test for morphine, ii, 375.
Lamb, *T.* See *V.* **Meyer**.
Lambardi, *G.* See *G.* **Grassi-Cristaldi**.
Lander, *G. Druce*. See *F. R.* **Japp**.
Landolt, *Hans H.*, method of determining rotatory dispersion by the aid of ray filters, ii, 1.
Lang, *Martin*. See *A.* **Bischler**.
Lang, *S.*, physiological action of acetonitrile and its homologues, ii, 238.
Langbein, *Heinrich*. See *F.* **Stohmann**.
Langer, *Julius*, volumetric estimation of officinal phosphoric acid, ii, 329.
Langmuir, *A. C.*, iodo- and iodosobenzenesulphonic acids, i, 230.
Lapicque, *Louis*, estimation of iron in urine, ii, 407, 421.
Lapicque, *Louis*, and *Ch.* **Marette**, minimum amount of nitrogen required by human beings, ii, 232.
Lapworth, *Arthur*, β-ethoxynaphthalenesulphonic acids. The arrest of isomeric change at an intermediate point, Proc., **1895**, 49.
Lasne, *Henri*, estimation of aluminium in phosphates, ii, 533.
Laspeyres (*E. A.*) *Hugo*, and *E.* **Kaiser**, meteoric iron of Verchne-Udinsk, ii, 402.
—— —— silicates of the Netschaëvo (Tula) meteorite, ii, 402.
Lassar-Cohn, ether, i, 259.
Lauder, *Alexander*. See *J. J.* **Dobbie**.
Laurie, *Arthur P.*, the electromotive force of an iodine cell, Proc., **1895**, 30.
Laws, *J. Parry*, antiseptic action of phenyl-substituted fatty acids, ii, 58.
Lea, *M. Carey*, solutions of metallic silver, ii, 166.
—— new methods of obtaining platinosochlorides, probable existence of a platinum subchloride, ii, 170.
—— the colour of atoms, ions, and molecules, ii, 441.
Leathes, *J. B.*, and *Ernest H.* **Starling**, absorption of salt solutions from the pleural cavities, ii, 321.
Le Bel (*J.*) *Achille*, optically active halogen derivatives, i, 585.
—— attempts to resolve unsaturated compounds into optically active constituents, ii, 98.
Le Chatelier, *Henri L.*, manganese steel, ii, 16.
—— heats of formation of some iron compounds, ii, 305.
—— alloys of definite composition, ii, 351.
—— copper-aluminium alloys, ii, 392.
Lecomte *H.*, and *Alexandre* **Hébert**, Moâbi seeds, ii, 285.
Leent, *Frederik H. van*. See *C. A. Lobry de* **Bruyn**.
Lefèvre, *Léon*, iodine green, i, 542.
Léger, *Eugéne*. See *É.* **Jungfleisch**.
Lehmann, *C.*, alkalinity of the blood, ii, 121.
Leidié, *Émile*. See *A.* **Joly**.
Lellmann, *Eugen*, and *Ludwig* **Ebel**, amido-derivatives of benzenylamidophenols, i, 415.
Lemoine, *A.*, free alkaline earths in rocks containing carbonates, ii, 171.
Lemoine, *Georges*, measurement of the intensity of light by the chemical changes produced in a mixture of ferric chloride and oxalic acid, ii, 249.

Lengfeld, *Felix*, salts of the acid $H_2S_2O_2$ (thiosulphurous acid), i, 258.

Lengfeld, *Felix*, and *Julius* **Stieglitz,** thiamines, i, 264.

—— —— imido-derivatives of carbonic acid, i, 277.

Lengyel, *B. v.*, the Kolop sulphur spring, ii, 118.

Lenoble, *E.*, correction in the determination of the titre of a liquid holding a precipitate in suspension; application to saccharimetry, ii, 135.

Lenz, *Wilhelm*, difficulty in the detection of chlorine in methylene blue, ii, 182.

Lenz, *Wilhelm*. See *F.* **Krüger.**

Leone, *R.* See *A.* **Peratoner.**

Lepercq, *Gaston*, action of methylic bromopropionate on sodium nitrite, i, 169.

—— ethylic nitrosopropionate, i, 169.

—— action of ethylic-α-bromopionate on alkali nitrites, i, 330.

—— alkylic nitrosobutyrates, i, 330.

Lepierre, *Charles*, quinine chlorohydrosulphate, i, 434.

—— atomic weight of thallium, ii, 166.

—— iron chromates, ii, 227.

—— manganese compounds, ii, 394.

Lépine, *Raphael*, the glycolytic ferment, ii, 277.

Le Roy, *G. A.*, development of the latent photographic image by alkali peroxides, ii, 66.

Lescoeur, *Henri*, chlorine in the gastric secretion, ii, 182.

—— hydrated metallic chlorides, ii, 269.

—— volumetric estimation of metals, ii, 418.

Lespieau, *Robert*, nomenclature of stereoisomerides, i, 489.

Levi, *E.* See *C. U.* **Zanetti.**

Levy, *A.*, the multirotation of dextrose, i, 586.

Levy, *Ludwig*, action of hydrogen peroxide on copellidine, i, 683.

Levy, *Ludwig*, and *Richard* **Wolffenstein,** stereoisomeric copellidines, i, 683.

Levy, *Siegmund*. See *C.* **Graebe.**

Lewin, *L.*, arrow poisons, ii, 123.

Lewis, *Percy B.*, a new method of determining the freezing points of very dilute solutions, Trans., 1.

Lichty, *D. M.*, influence of the substitution of halogens in acids on the rate of etherification, ii, 159.

Lieben, *Adolf*, relation between the constitution of fatty acids and the solubility of their salts, ii, 7.

Lieben, *Adolf*, reduction of carbonic anhydride at ordinary temperatures, ii, 348.

Liebermann, *Carl T.*, allofurfuracrylic acid, i, 212.

—— constitution of the bromocinnamic acids, i, 223.

—— α- and β-isatropic acids, i, 225.

—— action of bromine on alkylidenemalonic acids and their ethereal salts, i, 227.

—— derivatives of quercetin, i, 429.

—— molecular change produced in allofurfuracrylic acid and allocinnamylideneacetic acid by exposure to sunlight, i, 454.

—— cinnamylidenemalonic acid and the stereoisomeric cinnamylideneacetic acids, i, 470.

—— naphthazarin, i, 477.

Liebermann, *Carl T.*, and *Gustav* **Cybulski,** hygrine and hygric acid, i, 310.

Liebermann, *Carl T.*, and **H. Finkenbeiner,** an isomeric dichloride of cinnamic acid, i, 663.

Liebermann, *Carl T.*, and *Paul* **Michaelis,** analyses of cotton dyed with alizarin, i, 108, 671.

Lieblein, *Victor*, acidity of urine, ii, 55, 520.

Liebrich, estimation of phosphorus in iron and steel, ii, 530.

Liechti, *Paul*, apparatus for measuring out small drops of mercury for Kjeldahl's process, ii, 369.

Lightfoot, *Thomas M.*, chemical behaviour of arsenical pyrites, ii, 17.

Lilienfield, *Leon*, proteïn-like substances, i, 446.

—— blood coagulation, ii, 52.

Limb, *C.*, electromotive force of the Clark, Gouy, and Daniell standards, ii, 475.

Limpricht, *Heinrich*, paratoluoylorthobenzoic acid and benzophenonedicarboxylic acid, i, 422.

Linder, *S. Ernest*, and *Harold* **Picton,** solution and pseudo-solution. Part II. Some physical properties of arsenious sulphide and other solutions, Trans., 63.

Lindet, *Léon*, oxidation of the tannin of cider apples, i, 386.

Lindner, *Paul*. See **E. Fischer.**

Lindsey and **Holland,** digestibility of pentosans, ii, 404.

Lindström, *Gustaf*, elpidite, a new mineral from Greenland, ii, 401.

Linebarger, *Charles E.*, combination of sulphur with iodine, ii, 163.

—— application of the Schroeder-Le Chatelier law of solubility to solutions of salts in organic liquids, ii, 256.

Linebarger, *Charles E.*, reaction between zinc sulphate and potassium hydroxide, ii, 418.
Ling, *Arthur R.*, and *Julian L.* **Baker**, octacetylmaltose, TRANS., 212.
—— —— action of diastase on starch, TRANS., 702, 739.
Lingen, *L. v.* See *F.* **Krüger**.
Lintner, *Carl J.*, and **Georg Düll**. a second achroodextrin obtained by the action of diastase on starch, i, 409.
—— —— resolution of starch by the action of oxalic acid, i, 491.
Lintner, *Carl J.*, and *E.* **Kröber**, yeast glucase, i, 429.
Linton, *Laura A.*, technical analysis of asphaltum, ii, 333.
Lippmann, *Edmund O. v.*, two remarkable decomposition products of saccharose, i, 164.
—— occurrence of vanillin, ii, 129.
Lippmann, *Eduard*, apoquinine and its rotatory power, i, 688.
Lippmann, *Eduard* and *Franz* **Fleissner**, apoquinine derivatives, i, 436.
Littleton, *Fannie T.*, remarkable molecular change in a silver amalgam, TRANS., 239.
Livache, *Ach*, the drying of fats, i, 446.
Liveing, *George D.*, and *James* **Dewar**, spectrum of the electric discharge in liquid, oxygen, air, and nitrogen, ii, 33.
—— —— refraction and dispersion of liquid oxygen and the absorption of liquid air, ii, 471.
Liverseege, *John F.*, Bell's analyses of genuine milk, ii, 189.
Locher, *Jacob*, ethylic isophthalodicyanacetate, i, 45.
Locke, *F. S.*, an ideal circulating fluid for the isolated frog's heart, ii, 452.
—— action of distilled water on animal organisms, ii, 455.
Locke, *James*, thorium metaoxide and its hydrate, ii, 49.
Locke, *James*. See *P.* **Jannasch**.
Lockyer, *J. Norman*, spectra of gases evolved from certain minerals, ii, 430.
—— new gas obtained from uraninite, ii, 470.
Loczka, *József*, chemical constitution of iron pyrites, ii, 20.
Lodin, *Arthur*, reactions of lead sulphide, ii, 450.
Löb, *Walther*, action of amidoacetal on orthonitrobenzoic chloride and paranitrobenzoic chloride, i, 88.
Löb, *Walther*. See also **A. Classen**.
Loesner, *Hans*, reduction of aromatic nitrocompounds, i, 214.
Loesner, *Hans*, two new laboratory apparatus, ii, 163.
Loew, *Oscar*, methylenitan and formose, i, 164.
Loew, *Oscar*, and *M.* **Tsukamoto**, poisonous action of dicyanogen, ii, 129.
Löwenherz, *Richard*, rate of hydrolysis of some ethereal salts, ii, 107.
Loewy, *A.*, respiratory exchanges, ii, 119.
—— alkalinity of the blood, ii, 121.
Loewy, *A.*, and *N.* **Zuntz**, new theory of respiration, ii, 119.
—— —— alkalinity of fresh blood, ii, 121.
Löwy, *Ernst*. See *G. v.* **Georgievics**.
Lohmann, **P.**, estimation of chlorine in wool grease, ii, 326.
Lohnstein, *Theodor*, densimetric estimation of proteïd, ii, 192, 300.
Long, *John H.*, phenomena observed in the precipitation of antimony, from solutions of tartar emetic, ii, 399.
Lookeren, *C. J. van*, sugar of indican, i, 189.
Lookeren, *C. J. van*, and *P. J. van der* **Veen**, indigo, i, 96.
Loon, *J. van*, etherification of mellitic acid and of the two hydromellitic acids, i, 471.
Lorenz, *Richard*, preparation of stannic bromide, ii, 448.
—— two modifications of stannic acid, ii, 448.
Lossen, *Clemens*, new method of extracting gold from auriferous ores by means of bromine, ii, 19.
Lossen, *Wilhelm C.*, occurrence of polymorphous modifications of derivatives of hydroxylamine, i, 37.
Lotz, *Dumont*. See *E. W.* **Stone**.
Louguinine, *W.* See **Luginin**.
Lovén, *Johan M.*, preparation of thiodiglycollic acid, i, 82.
—— conductivity of permanganic acid, ii, 451.
Luboldt, *W.*, scopoleïne, i, 632.
Lucas, *A.* See *A.* **Hantzsch**.
Lüdy, *Fritz*, guaiacol and its derivatives, i, 513.
Luggin, *H.*, electrocapillary phenomena, ii, 303.
Luginin, *Wladimir F.*, heat of vaporisation of saturated fatty alcohols, ii, 101.
—— Trouton's law and the saturated fatty alcohols, ii, 101.
Luib, *Alfons*. See *R.* **Fittig**.

Lumière, *Auguste, Louis* **Lumiere,** and *Alphonse* **Seyewitz,** reduction of aromatic nitro-derivatives in neutral solution: formation of aromatic hydroxylamines, i, 417.
Lunge, *Georg,* litmus and methylorange as indicators, ii, 242.
—— universal gas volumeter, ii, 287.
—— estimation of sulphur in pyrites, ii, 291.
—— assay of fuming sulphuric acid, ii, 413.
Lunge, *Georg.* and **G. Porschnew,** nitrous anhydride, ii, 12.
Lungwitz, *E.* See *H.* **Schweitzer.**
Luxembourg, *K.* See *C. A. A.* **Michaelis.**
Luxmore, *Charles M.*, α-ethylenedihydroxylamine dihydrobromide, TRANS., 1018.
—— alleged isomerism of potassium nitrososulphate, TRANS., 1019.
—— the oximes of benzaldehyde and their derivatives, PROC., **1895**, 149.
Lychenheim, estimation of phosphorus in coal and coke, ii, 328.
Lyman, *James, A.*, phthaleïns of orthosulphoparatoluic acid, i, 183.
Lyttkens, *Aug.*, effect of arsenic on vegetation, ii, 410.

M.

Mabery, *Charles F.*, estimation of sulphur in volatile organic compounds, ii, 136.
Macallum, *A. B.*, distribution of assimilated iron compounds other than hæmoglobin and hæmatin in vegetable and animal cells, ii, 518.
MacCallum, *William, jun.*, derivatives of ethylorthotoluidine, TRANS., 246.
McCrae, *John,* iodonium bases from pariodotoluene, i, 221.
—— measurement of high temperatures and the melting points of some inorganic salts, ii, 339.
MacDonald, *George W.*, and *Alexander M.* **Kellas,** is argon contained in vegetable and animal substances? ii, 516.
McElroy, *K. T. P.*, contraction of aqueous solutions of acetone, i, 15.
—— estimation of iron and aluminium in phosphates, ii, 293.
Macfadyen, *Allan,* and *F. R.* **Blaxall,** thermophilic bacteria, ii, 58.
Mach, *Heinrich,* abietic acid, i, 384.
Mackenzie, *John E.* See *R.* **Fittig.**
Maclaurin, *J. S.*, action of potassium cyanide solutions on gold and silver, TRANS., 199.
McLeod, *Herbert,* Schuller's yellow modification of arsenic, ii, 44.
—— action of hydrogen on amorphous phosphorus, ii, 348.
McMillan, *Walter, G.*, two new colorimeters for carbon estimations, ii, 416.
Macnab, *William,* and *E.* **Ristori,** researches on modern explosives, ii, 434.
McPherson, *William.* See *H. A.* **Weber.**
Magee, *W. H.* See *L. M.* **Dennis.**
Mahla, *Friedrich,* and *Ferdinand* **Tiemann,** oxidation of camphoric acid, i, 678.
Mai, *Ludwig.* See *A.* **Hantzsch.**
Mailfert, *L'Abbé,* solubility of ozone in water, ii, 216.
Malagnini, *Giovanni,* action of nitrous acid on isomethyleugenol, i, 35.
Malagnini, *Giovanni.* See also *A.* **Angeli.**
Malbot, *H.*, and *A.* **Malbot,** formation of mannitol in wines, i, 198.
Mallard, *E.*, boleite, cumengeite, and percylite, ii, 115.
Mallèvre, *Alfred.* See *G.* **Bertrand.**
Mallory, *F. B.*, calcareous concretions in the brain, ii, 53.
Manassee, *Paul,* phosphorus and sugar yielding constituents of liver and suprarenal bodies, ii, 278.
Mangin, *Louis,* properties and reactions of pectous substances, i, 8.
Mangold, *Carl,* apparatus for reflux or for distillation, ii, 260.
Mann, *F.*, and *Bernhard* **Tollens,** estimation of glycuronic acid by its yield of furfuraldehyde, ii, 335.
Mann, *Harold H.* See *H.* **Ingle.**
Maquenne, *Léon,* a new laboratory barometer, ii, 162.
—— leaf respiration, ii, 175.
Marburg, *Richard,* action of ethylic isosuccinate on ethylenic bromide: constitution of vinaconic acid, i, 171.
Marchetti, *G.*, a new alcohol from lanolin, i, 408.
Marchlewski, *Leo,* constitution of glucosides and glucoses, i, 490.
—— racemism, i, 506.
Marchlewski, *Leo.* See also *E.* **Schunck.**
Marckwald, *Willy,* constitution of ring systems, i, 244.
—— constitution of indene, i, 535.
Marette, *Ch.* See *L.* **Lapicque.**
Marie, *Theod.*, free acids from beeswax, i, 81.
Marignac, *Jeans Charles Gallissard de,* memorial lecture on, TRANS., 468.

Marino-Zuco, *Francesco*, chrysanthemine, i, 631.

Marino-Zuco, *Francesco*, and *C.* **Martini**, neurine in blood, ii, 454.

Marino-Zuco, *Francesco*, and *G.* **Vignolo**, alkaloïds of *Cannabis indica* and *C. sativa*, i, 631.

Markovnikoff, *Wladimir B.*, occurrence of hexanaphthene in Caucasian naphtha, i, 271.

Markovnikoff, *Wladimir B.*, and *Michaël* **Konovaloff**, isomeride of hexanaphthene (hexamethylene), i, 454.

Marquardt, *B.*, action of diazo-compounds on ethylic cyanacetate, i, 659.

Marsh, *Charles W.*, copper iodide (marshite), from Broken Hill, N.S.W., ii, 504.

Marshall, *B. M. C.* See *W. A.* **Tilden.**

Marshall, *J. W.*, anilido- and paratolylamido-β-naphthaleneazobenzoic acids, i, 238.

Martini, *C.* See *F.* **Marino-Zuco.**

Martz, *Eduard.* See *C.* **Haeussermann.**

Mascioni, *B.* See *F.* **Kehrmann.**

Massey, *Cecil*, composition of soils from South India, ii, 366.

Massol, *Gustave*, rotatory power of oil of spike and oil of lavender, i, 294.

—— thermal properties of nitrobenzoic acids, ii, 202.

Matignon, *Camille*, metallic derivatives of formylcarbamide, acetylcarbamide, and oxaluric acid, i, 269.

—— salts of carbamide, i, 270.

—— hydrate of uric acid, i, 270.

—— heat value of proteïds in the organism, ii, 359.

Matignon, *Camille.* See also *M.* **Berthelot.**

Matthes, *Max*, leucæmic blood, ii, 123.

Maumené, *Edme J.*, purification of alcohols, sugars, and other organic substances, i, 260.

—— action of potassium permanganate on various carbon compounds, i, 443.

Maupy, *L.*, detection of castor oil in copaiba balsam and in croton oil, ii, 147.

Mayer, *Adolf*, composition of the root nodules of the alder, ii, 523.

Mayer, *Ernst.* See *R.* **Fittig.**

Mayr, *Heinrich*, the resin of German pines, ii, 365.

Meimberg, *Franz.* See *E.* **Bamberger**, *W.* **Koenigs.**

Meineke, *C.*, iodide of starch reaction, i, 79.

—— sodium thiosulphate for standardising iodine solutions, ii, 63.

—— potassium hydrogen tartrate in volumetric analysis, ii, 525.

Meissels, *K.* See *W.* **Kalmann.**

Meldola, *Raphael*, and *Ernest R.* **Andrews**, the action of nitrous acid on 2 : 5-dibromaniline, Proc., **1895**, 109.

Meldola, *Raphael*, and *Frederick W.* **Streatfeild**, isomeric dinitrodiazoamidobenzenes and their melting points, Trans., 50.

—— —— homonucleal tri-derivatives of naphthalene, Trans., 907.

Melville, *William H.*, analyses of natrolite, tourmaline, spessarite, bismuthinite, and felspar, ii, 510.

Menozzi, *Angelo.* See *W.* **Korner.**

Menschutkin, *Nicolai A.*, velocity of formation of amines and of alkylammonium salts, ii, 385.

Menzies, *J. A.*, methæmoglobin, i, 256.

—— action of acids on hæmoglobin, i, 256.

Mer, *Émile*, action of calcium and potassium salts on the herbage of meadows, ii, 458.

Merrill, *Walter.* See *E. J.* **Bartlett.**

Messner, *J.*, crystalline copper ferrocyanides, i, 405.

—— ferrocyanides, i, 486.

Methner, *Theodor*, action of formaldehyde on quinaldine, i, 71.

Metzner, *R.*, combination of hydrogen fluoride with water, ii, 108.

Meyenberg, *Alexander*, condensation of ethylic malonate with acetone, i, 334.

Meyenberg, *Alexander.* See also *A.* **Einhorn.**

Meyer, *Carl.* See *W.* **Koenigs.**

Meyer, *Ernst v.*, bimolecular nitriles and their derivatives, i, 582.

Meyer, *Hans.* See *J.* **Herzig.**

Meyer, *Lothar*, ethane and propane, i, 1.

—— preparation of the paraffins, i, 2.

—— explosion of acetylene, i, 2.

—— constitution of rosanilines, i, 278.

—— an aluminium air-bath, ii, 9.

Meyer, *Lothar*, and *Karl* **Seubert**, ratio of the atomic weights of hydrogen and oxygen, ii, 9.

Meyer, *Richard*, constitution of fluoresceïn, i, 291.

—— constitution of fluoresceïn. Ethereal salts and mixed anhydrides of phthalic acid, i, 538.

Meyer, *Richard*, and *Julius* **Schäfer**, alkylated azo-compounds and the theory of dyeing, i, 135.

Meyer, *Victor*, formation of dicarbon compounds from carbon bisulphide at low temperatures, i, 77.

—— aromatic nitro-derivatives, i, 91.

Meyer, *Victor,* diagnosis of orthosubstituted aromatic acids by means of the iodoso-reaction, i, 178.
—— sodionitromethane, i, 197.
—— etherification of aromatic acids, i, 228, 466.
—— the molecular state of mercurous chloride vapour, ii, 46, 166.
Meyer, *Victor, W.* **Riddle,** and *Th.* **Lamb,** melting point determinations at a red heat, ii, 36.
Meyer, *Victor,* and *J. Joseph* **Sudborough,** law of etherification of aromatic acids, i, 93.
Meyer, *Victor.* See also *G. Heyl.*
Michael, *Arthur,* addition of sulphur to unsaturated organic compounds, i, 509.
—— melting point of difficultly fusible organic compounds, ii, 378.
Michael, *Helen Abbott,* constitution of phloretin, i, 45.
Michaelis, (*C. A.*) *August,* some mercury compounds of the aromatic series, i, 368.
—— action of inorganic chlorides on piperidine and the fatty amines, i, 430.
Michaelis, (*C. A.*) *August,* and *G.* **Erdmann,** thionylamines of amidoazoderivative and of naphthylenediamines, i, 669.
Michaelis, (*C. A.*) *August,* and *W.* **Kärsten,** thiophosphazo-compounds, i, 462.
Michaelis, (*C. A.*) *August,* and *Fritz* **Kuhlmann,** tolyl- and phenyl-anilidophosphonium derivatives, i, 662.
Michaelis, (*C. A.*) *August,* and *K.* **Luxembourg,** suggested non-existence of isopropyleneparamidophenol, i, 87.
—— —— a new series of sulphur derivatives of aliphatic amines, i, 200.
—— —— *n*-phosphines and *n*-phosphonium derivatives, i, 682.
Michaelis, *Paul.* See *C.* **Friedheim,** *C. T.* **Liebermann.**
Michaels, *Hugo.* See *M.* **Freund.**
Michaud, *Gustave,* influence of certain metals on the stability of ammonium amalgam, ii, 109.
Mielke, *G.,* place of tannins in plant metabolism, ii, 324.
Mierczynski, *v.,* gas volumetric estimation of hydrochloric acid in the contents of the stomach, ii, 526.
Milch, *Ludwig,* new arsenate from Laurion, ii, 172.
Miller, *Wilhelm v.,* and *Joseph* **Plöchl,** the carbodiphenylimides, i, 415.
Miller, *Wilhelm v.,* and *Georg* **Rhode,** constitution of cinchonine, i, 434.
Mills, *Charles,* some new azo-compounds, Trans., 925.
Milone, *Ugo,* modification of Tollens' fat extraction apparatus, ii, 373.
Minguin, *Jules.* See *A.* **Haller.**
Minor, *Wilhelm,* preparation of lead dioxide, ii, 315.
Miolati, *Arthur,* constitution of the rosanilines, i, 540.
Mitchell, *Charles A.* See *O.* **Hehner.**
Mitjukoff, *Katharina,* paramucin, ii, 361.
Miura, *K.,* Does inulin lead to the formation of glycogen in vegetable feeders? ii, 404.
—— inversion of cane sugar in the small intestine, ii, 405.
—— grape sugar in blood, ii, 405.
—— alimentary glycosuria, ii, 406.
Mixer, *C. T.,* and *H. W.* **Dubois,** the Zimmermann-Reinhardt method for estimating iron in iron ores, ii, 420.
Mixter, *William G.,* azo- and azimido-compounds, i, 520.
Möhlau, *Richard,* action of benzylamine on ethylic acetoacetate, i, 140.
Möhlau, *Richard,* and *P.* **Koch,** fluorresceïn colouring matters, i, 46.
Möhlau, *Richard,* and *Arthur* **Neubert,** action of nitrosodimethylaniline on tertiary and secondary aromatic amines in presence of concentrated hydrochloric acid (and formaldehyde), i, 213.
Mörner, *Carl T.,* chondroitin-sulphuric acid, i, 254.
—— butter, ii, 374.
Möslinger, *W.* See *A.* **Halenke.**
Mohr, *Paul,* sulphur in various keratin substances, i, 255.
—— estimation of sulphur in urine, ii, 528.
Moissan, *Henri,* volatilisation of carbon, ii, 164.
—— graphite, ii, 219.
—— displacement of carbon from fused cast iron by boron and silicon, ii, 220.
—— graphites from iron, ii, 220.
—— intumescent graphite, ii, 221.
—— reduction of aluminium by carbon, ii, 226.
—— iron boride, ii, 270.
—— titanium, ii, 272.
—— argon and fluorine, ii, 388.
—— reduction of silica by carbon, ii, 497.
—— molybdenum, ii, 501.
Moissan, *Henri,* and *Georges* **Charpy,** boron steel, ii, 269.
Mole, *P.* See *A.* **Angeli.**
Molinari, *Ettore,* nature and cause of osmotic pressure, ii, 381.
Molisch, *Hans,* phycoerythrin, i, 556.

Monari, *Adolfo*, and *L.* **Scoccianti**, pyridine produced during coffee roasting, i, 624.

Mond, *Ludwig*, *William* **Ramsay**, and *John* **Shields**, occlusion of oxygen and hydrogen by platinum black, ii, 492.

Monnet, *E.*, calorimetric behaviour of saline solutions; sodium acetate, ii, 255.

Monnet, *Paul*, apparatus for fractional distillation, ii, 387.

Monnier, *Denis*, and *H.* **Auriol**, volumetric estimation of nitric acid, ii, 86.

Montanari, *C.* See *F.* **Garelli.**

Montemartini, *Clemente.* See *E.* **Paternò.**

Monteverde, *Nicolai A.*, protochlorophyll, i, 429.

Montfort, *W.* See *R.* **Anschütz.**

Moody, *Gerald T.*, studies in isomeric change. Part IV. Ethylbenzenesulphonic acids, PROC., **1895**, 47.

Moore, *B.*, relation between the surface tension and osmotic pressure of solutions, ii, 41.

—— the physiologically active substance occurring in the suprarenal gland, ii, 236.

Moore, *Thomas*, chocolate nickel ores from New Caledonia, ii, 117.

—— action of reducing agents on potassium nickelocyanide: magnetic oxide of nickel, ii, 168.

—— volumetric estimation of nickel, ii, 534.

Moraczewski, *Waclaw v.*, behaviour of caseïn in ammoniacal magnesium chloride solution, i, 691.

—— phosphorus in digestion products of caseïn, ii, 54.

—— the blood in cancer, ii, 280.

Moreigne, *Henri*, estimation of total nitrogen in urine, ii, 327.

—— estimation of total sulphur in urine, ii, 327.

Morell, *Robert S.* See *S.* **Ruhemann.**

Morgan, *J. L. R.*, dissociation of cyanides, ii, 478.

Morley, *Edward W.*, atomic weight of oxygen, ii, 261.

Morozewicz, *J.*, artificial spinel and corundum, ii, 275.

Morpurgo, *G.*, analysis of castor oil, ii, 147.

Morris, *G. Harris*, the hydrolysis of maltose by yeast, PROC., **1895.**, 46.

Morris, *G. Harris.* See also *H. T.* **Brown.**

Morse, *Harmon N.*, and *Thomas L.* **Blalock**, instruments for the graduation and calibration of volumetric apparatus, ii, 134.

Mosczyc, *M.* See *P.* **Friedlaender.**

Moseley, *H. P.* See *F. A.* **Gooch.**

Moses, *A. J.* See *E.* **Waller.**

Mosnier, *A.*, combination of lead iodide with metallic iodides and with organic iodides, ii, 268.

Moureu, *Charles*, conversion of carbamide into cyanamide, i, 411.

—— action of thionyl chloride on inorganic and organic acids and aldoximes, ii, 43.

Mrazec, *L.* See *L.* **Duparc.**

Mühle, *K.* See *R.* **Otto.**

Müller, *E.* See *J.* **Pinnow.**

Müller, *Franz.* See *S.* **Gabriel.**

Müller, *Hermann*, parahydrazidophenyl, i, 97.

Müller, *Hermann.* See also *R.* **Anschütz.**

Müller-Erzbach, *Wilhelm*, vapour pressure of the combined water in copper sulphate and barium chloride, ii, 486.

Müntz, *Achille.* See *G. A.* **Chatin.**

Muir, *M. M.* **Pattison**, and *Edwin M.* **Eagles**, note on the interaction of bismuth haloïd compounds and hydrogen sulphide, TRANS., 90.

Mulder, *Eduard*, ketonic compound from tartaric acid: parapyruvic acid, i, 449.

Muller, *Joseph A.*, estimation of mannitol by the optical method, ii, 141.

—— estimation of mannitol in wines, ii, 334.

Muller, *Paul Th.* See *A.* **Haller.**

Munk, *Immanuel*, metabolism, ii, 78.

Munsche, *A.*, estimation of starch by alcoholic fermentation, ii, 144.

Muntendam, *H. P.* See *A.* **Bischler.**

Murril, *Paul.* See *J. H.* **Kastle.**

Muthmann, *Wilhelm*, and *O.* **Kuntze**, solubility of mixed crystals of pairs of isomorphous salts, ii, 7.

Muthmann, *Wilhelm.* See also *A. S.* **Eakle.**

Muynck, *R. de*, refractive indices of aqueous solutions of cadmium salts, ii, 33.

Mylius, *Franz*, iodine compounds of starch and of cholic acid, i, 313.

Mylius, *Franz*, and *Otto* **Fromm**, purification of zinc, ii, 390.

N.

Nabarro, *D. N.*, proteïds of suprarenal capsules, ii, 236.

Nabarro, *D. N.* See also *L.* **Hill.**

Naegeli, *Ernest*, benzenylamidothiophenols, i, 347.

—— parethoxyazobenzene, i, 353.

—— benzanilide, i, 360.

Nahm, *A. N.*, new method of estimating fat in milk, ii. 374.

Nassauer, *Max.* See *W.* **Wislicenus.**

Natanson, *Ladislaus*, critical temperature of hydrogen, ii, 379.

Natterer, *Konrad*, water and sea-bottom deposits from the Eastern Mediterranean, ii, 51.

—— water of the Sea of Marmora, ii, 515.

Nef, *John U.*, constitution of salts of the nitro-paraffins, i, 3.

—— bivalent carbon, i, 9.

Negri, *G. de*, and *Guido* **Fabris**, oils, ii, 247.

Nencki, *Marcellus*, gallacetophenone, i, 44.

—— behaviour of the aromatic hydroxyketones in the animal organism, ii, 25.

—— pancreatic digestive products of albumin, ii, 233.

—— thiocyanic acid in the juices of the stomach, ii, 361.

Nernst, *Walther*, and *Richard* **Abegg**, freezing points of dilute solutions, ii, 155.

Neubauer, *Hugo*, estimation of nitrogen and phosphoric acid, ii, 243.

Neubert, *Arthur.* See *R.* **Möhlau.**

Neumann, *Franz.* See *O.* **Wallach.**

Neumann, *Georg*, double salts of higher chlorides of manganese and copper, ii, 46.

—— estimation of the heavy metals by titration with sodium sulphide, ii, 64.

Neumann, *J.*, effect of calcium phosphate and carbonate on increase of live weight, ii, 173.

Neumeister, *Richard*, egg shells of Echidna and other vertebrates, ii, 54.

Neville, *Francis H.* See *C. T.* **Heycock.**

Nevole, *M.*, estimation of alkalinity in raw sugars, ii, 532.

Nickel, *Emil*, new colour reaction of iridol, i, 87.

Niederhofheim, *Robert.* See *P.* **Jannasch.**

Niementowski, *Stefan v.*, phenometadiazine derivatives, i, 306.

—— derivatives of metamethylbenzoylorthouramide, i, 524.

—— synthesis of quinazolines, i, 571.

Nietzki, *Rudolf*, the bleaching powder reaction for aniline, i, 132.

—— constitution of the safranines, i, 462.

Nietzki, *Rudolf*, the fluorindines, i, 477.

Nietzki, *Rudolf*, and *Heinrich* **Bothof**, thioanilines, i, 132.

Nietzki, *Rudolf*, and *Emil* **Braunschweig**, action of alkalis on orthonitrophenylhydrazine, i, 135.

Nietzki, *Rudolf*, and *Paul* **Schröter**, constitution of fluoresceïn, i, 183.

Nihoul, *Ed.*, estimation of sugar by Fehling's solution, ii, 142.

Nihoul, *Ed.* See *L. L. de* **Koninck.**

Nilson, *Lars F.*, manuring experiments with various phosphates and nitrogenous substances, ii, 180.

Nitze, *H. B. C.*, monazite from North Carolina, ii, 319.

Noll, *K.*, thermoelectric properties of some metals, ii, 99.

Norden, *v.*, and *K.* **Belgardt**, assimilation of lime in the body during disease, ii, 120.

Nordenskiöld, new source of uranium, ii, 398.

Nordenskjöld, *Gustaf*, microlite, parasite, and elpidite from Greenland, ii, 401.

Norris, *R. S.*, action of light on lead bromide, ii, 267.

Norwall. See **Konek** *v.* **Norwall.**

Noyes, *Arthur A.*, velocity of the reaction between ferric and stannous chlorides, ii, 257.

Noyes, *Arthur A.*, and *Charles G.* **Abbot**, solubility experiments, ii, 207.

Noyes, *Arthur A.*, and *A. A.* **Clement**, electrolytic reduction of paranitrobenzoic acid, i, 178.

Noyes, *Arthur A.*, and *W. R.* **Whitney**, cryoscopic researches on alkali aluminates and borates, ii, 156.

Noyes, *William A.*, camphoric acid, i, 187, 295, 552.

Noyes, *William A.*, and *E. D.* **Frohman**, volumetric estimation of phosphorus in steel, ii, 30.

Noyes, *William A.*, and *J. S.* **Royse**, volumetric estimation of phosphorus in steel and cast iron, ii, 414.

Nuricsan, *J.*, the Torda brine springs, ii, 118.

O.

Oates, *William H.*, attempts to estimate sulphur compounds in the atmosphere, Proc., **1894**, 218.

Oberlaender, *Paul*, balsam of tolu, i. 188.

Obermayer, *Fritz*, and *Richard* **Kerry**, albuminous fermentation, ii, 283.

Oddo, *Giuseppe*, maximum temperature of formation and temperature of decomposition of some aromatic diazochlorides, i, 514.

—— constitution of isonitrosoketones, i, 623.

Oddo, *Giuseppe*, and *A.* **Curatolo**, synthesis of diphenylic hydrocarbons: para- and ortho-phenyltoluenes, i, 606.

Oechsner de Coninck, *William*, reactions of amidobenzoic acids, i, 280.

—— nitrobenzoic acids, i, 364.

—— elimination of magnesium compounds in cases of rachitis, ii, 455.

Oehmichen, *Richard*, assay of alloys containing gold, silver, zinc, and tin, ii, 295.

Oenslager, *George*. See *C. L.* **Jackson**, *T. W.* **Richards.**

Oettel, *Felix*, electrolytic estimation of copper in ammoniacal solution, ii, 139.

Oettinger, *Karl*, conversion of symmetrical triamidophenol into 1 : 2 : 3 : 5-phentetrol, i, 457.

—— acetyl derivatives of symmetrical triamidophenol, i, 458.

Ogden, *H. V.*, alcaptonuria, ii, 83.

Olgiati, *Ludwig*, diphenylbenzenes, i, 149.

Oliver, *George*, and *Edward A.* **Schäfer**, physiological action of extract of suprarenal capsules, ii, 235.

Oliver, *George*. See also *E. A.* **Schäfer.**

Oliveri, *Vincenzo*, constitution of nicotine, i, 433.

Olszewski, *Karl*, ethane and propane: a correction, i, 122.

Onimus, *E.*, dialysis of beer yeast, ii, 83.

Ormandy, (*W.*) *Reginald*. See *J. B.* **Cohen.**

Orndorff, *William R.* ,and *Miss L. L.* **Balcom**, polymeric modifications of propaldehyde, i, 200.

Orndorff, *William R.*, and *F. K.* **Cameron**, boiling point apparatus for molecular weight determinations, ii, 480.

Orton, *K. J. P.* See *S.* **Ruhemann.**

Ōsaka, *Yūkichi*. See *T.* **Haga.**

Ostwald, *Wilhelm*, scientific electrochemistry of the present, and technical electro-chemistry of the future, ii, 99.

—— the chemometer, ii, 108.

—— methods of physico-chemical measurements, ii 491.

Oswald, *A.* See *K.* **Auwers.**

Otto, *Paul*, diphenylamine-*n*-oxychlorophosphine, i, 363.

Otto, *Paul*, 1 : 4-chloraniline-*n*-oxychlorophosphine, i, 364.

Otto, *Robert*, vinyltriphenylsulphone (triphenylsulphonethane), i, 96.

—— unsaturated sulphones: allylphenylsulphone, allylparatolylsulphone, i, 229.

—— homologues of ethylenediphenylsulphone and ethyleneditolylsulphone: action of halogen alkylene compounds on mercaptides, i, 286.

—— synthesis of sulphones from sodium alkylic sulphinates by the action of potassium alkylic sulphates, i, 337.

Otto, *Robert*, and *K.* **Mühle**, preparation of ethylidenediphenylsulphone, i, 422.

—— —— analogy between the behaviour of halogen-alkylenes towards sodium, on the one hand, and towards mercaptides on the other, i, 485.

P.

Paal, *Carl*, and *Franz* **Fritz**, action of orthonitrobenzylic chloride on unsymmetrical hydrazines, i, 353.

Paal, *Carl*, and *H.* **Reckleben**, action of orthohydroxybenzylic alcohol (saligenin) on aromatic diamines, i, 346.

Pagnoul, saline constituents of potatoes and oats, ii, 130.

Palache, *Charles*, crossite, a new soda amphibole, ii, 513.

Palladin, *Wladimir*, respiration of green and etiolated leaves, ii, 176.

Palladino, *Pietro*, new alkaloïd contained in coffee, i, 629.

Palmer, *Chase*, chromates of the rare earths. I. Chromates of thorium, ii, 357.

Panajotow, *Georg*, 1 : 3-dimethylquinophthalone and 1 : 3-dimethylquinaldic acid, i, 566.

Papendieck, *August*. See *E.* **Buchner.**

Parenty, *H.*, and *E.* **Grasset**, nicotine oxalate and other salts, i, 309.

Parker, *Harry G.* See *T. W.* **Richards.**

Parlato, *Emilio*. See *E.* **Becker.**

Partheil, *Alfred*, identity of cytisine and ulexine, i, 119.

—— cytisine and ulexine, i, 254.

Pascheles, *W.*, change of cyanogen compounds in the body, ii, 238.

Pasquali, *Adalberto*, chemical and toxicological properties of hydroxylamine, ii, 413.

Pasqualis, *Giusto*, absorption and

elimination of glycerophosphoric acid, ii, 237.

Pate, *Lewis*. See *A. G.* **Perkin.**

Paternò, *Emanuele*, the polymerides of epichlorhydrin, i, 408.

Paternò, *Emanuele*, and *F.* **Crosa**, sordidin, i, 388.

Paternò, *Emanuele*, and *Clemente* **Montemartini**, volume changes attending the mixture of liquids in relation to cryoscopic behaviour, ii, 6.

—— —— maximum depression of the freezing point of mixtures, ii, 205.

—— —— paraxylene as the solvent for cryoscopic investigations, ii, 207.

Paturel, *G.*, agricultural value of various natural phosphates, ii, 28.

—— estimation of the manurial value of phosphates, ii, 461.

Paulmann, *W.*, sarcosine, i, 175.

Pauly, *Hermann*. See *R.* **Anschütz.**

Pautz, *Walther*, metabolism in diabetes, ii, 406.

Pautz, *Walther*, and *J.* **Vogel**, action of the mucous membrane of the stomach and intestines on some bioses and on raffinose, ii, 403.

Pawlewski, *Bronislaw*, action of phthalic chloride on dinitrodiazoamidobenzene, i, 134.

—— isophenolphthaleïn and allofluoresceïn, i, 219.

—— diphenylorthophthalide, i, 290.

—— action of phthalic chloride on nitranilines, i, 414.

Pechmann, *Hans v.*, diazomethane, i, 328, 493.

—— mixed amidines and tautomerism, i, 347.

—— action of alkali sulphites on aromatic diazo-compounds, i, 370.

—— benzenesulphinic acid derivatives of diazobenzene, i, 371.

—— action of alkali sulphites on fatty diazo-compounds, i, 642.

Pechmann, *Hans v.*, and *Ludwig* **Frobenius**, aromatic diazo-compounds, i, 215.

Pechmann, *Hans v.*, and *Paul* **Runge**, oxidation of formazyl compounds, i, 74.

Pechmann, *Hans v.*, and *Edgar* **Wedekind**, constitution of tetrazolium bases, i, 574.

—— —— the aldol of diacetyl, i, 647.

Peckham, *S. F.*, origin of bitumens, ii, 115.

Peirce, *Benjamin O.*, thermoelectric properties of platinoïd and manganine, ii, 152.

Pellizzari, *Guido*, new synthesis of triazole and its derivatives, i, 308.

Pellizzari, *Guido*, and *G.* **Cuneo**, urazoles and triazoles, i, 73.

Pemberton, *Henry, jun.*, estimation of phosphoric acid, ii, 415.

Pembrey, *Marcus S.*, regulation of heat production, ii, 232.

—— the output of carbonic anhydride, and temperature, ii, 452.

Pembrey, *Marcus S.*, *M. H.* **Gordon**, and *R.* **Warren**, heat production in the chick before and after hatching, ii, 51.

Pembrey, *Marcus S.*, and *W. Hale* **White**, heat regulation in hybernating animals, ii, 452.

Pennington, *Mary E.*, and *Edgar F.* **Smith**, atomic weight of tungsten, ii, 230.

Penschuck, *Max*. See *R.* **Fittig.**

Peratoner, *Alberto*, acetol ethylic ether and the formation of epiethylin, i, 5.

Peratoner, *Alberto*, and *A.* **Genco**, action of sulphuryl chloride on phenols and their ethers, i, 342.

Peratoner, *Alberto*, and *R.* **Leone**, synthesis of comenic acid: chloropyromeconic acid, i, 22.

Perkin, *Arthur G.*, kamala. Part II. Trans., 230.

—— derivatives of β-resorcylic acid, Trans., 990.

—— some constituents of the root of *Polygonum cuspidatum*, Trans., 1084.

Perkin, *Arthur G.*, and *Frank* **Cope**, the constituents of *Artocarpus integrifolia*. Part I. Trans., 937.

Perkin, *Arthur G.*, and *Julius* **Geldard**, a constituent of Persian berries, Trans., 496.

Perkin, *Arthur G.*, and *John J.* **Hummel**, the colouring principles of *Toddalia aculeata* and *Evodia meliæfolia*, Trans., 413.

—— —— the colouring and other principles contained in chay root, Trans., 817.

Perkin, *Arthur G.*, and *Lewis* **Pate**, acid compounds of some natural yellow colouring matters, Trans., 644.

Perkin, *Arthur G.* See also *C. S.* **Bedford.**

Perkin, *William H.*, *sen.*, the magnetic rotation of some unsaturated hydrocarbons, Trans., 255.

Perkin, *William H.*, *jun.*, sulphocamphylic acid. Part II., Proc., **1895**, 23.

Perkin, *William H.*, *jun.*, and *J. Joseph* **Sudborough**, the reduction of chlorides of organic acids, Proc., **1894**, 216.

Perkin, *William H.*, *jun.* See also *A.*

W. **Bone**, *W.* **Goodwin**, *E.* **Haworth.**

Perman, *Edgar P.*, rate of escape of certain gases from solutions of varying concentration, Trans., 868, 983.

—— the existence of hydrates and of double compounds in solution, Proc., **1895**, 87.

Perman, *Edgar P.*, and *W.* **John**, standardising acid solutions, ii, 368.

Perrier, *G.*, combination of borneol, camphor, and chlorocamphor with aluminium chloride, i, 60.

—— combination of aluminium chloride with nitro-derivatives of the benzene series, i, 510.

—— combination of nitriles with aluminium chloride, i, 636.

Perrin, *Heinrich.* See *R.* **Fittig.**

Pesci, *Leone*, action of acetanilide on mercuric acetate, i, 357.

Pěske, *Zdeněk*, the volumetric estimation of sugars by an ammoniacal cupric solution, Proc., **1895**, 43.

Peters, *R.*, rennet and similar ferments, ii, 80.

Petersen, *Emil*, velocity of etherification of methylic alcohol, ii, 258.

Petit, *Paul*, variation in the sugars during the germination of barley, ii, 363.

Petrini, *H.*, specific heat of gases, ii, 199.

Peyrou, *J.*, atmospheric ozone, ii, 240.

Pfaff, *F. W.*, formation of magnesite and dolomite, ii, 50.

Pfeiffer, *Theodor*, and *E.* **Franke**, utilisation of elementary nitrogen by mustard, ii, 521.

Pfeiffer, *Theodor*, and *H.* **Thurmann**, estimation of nitric nitrogen in presence of organic nitrogen, ii, 369.

Phear, *Arthur G.* See *S.* **Ringer.**

Phelps, *I. K.* See *F. A.* **Gooch.**

Philips, *Alfred*, anthrapyridine, i, 567.

—— amidoquinoxalinecarboxylic acid, i, 572.

—— modification of Soxhlet's extraction apparatus, ii, 411.

Piccini, *Augusto*, green chromic chloride, $CrCl_3,6H_2O$, ii, 229.

Piccinini, *Antonio*, mercurioacetanilides, i, 358.

—— organic mercuric compounds derived from aniline, i, 358.

Pichard, *P.*, assimilability of potassium in poor sandy soils by the action of nitrates, ii, 60.

Pick, *Friedel*, the liver, and the metabolism of carbohydrates, ii, 360.

Pickering, *John W.*, coagulation of colloïds, i, 314.

Pickering, *John W.*, synthesised colloïds and coagulation, i, 484.

—— action of drugs on the heart of *Daphnia*, ii, 57.

—— physiological action of chlorocaffeïne and cyanocaffeïne, ii, 238.

Pickering, *John W.*, and *William D.* **Halliburton**, synthesised colloïds and coagulation, ii, 454.

Pickering, *Spencer U.*, a comparison of some properties of acetic acid and its chloro- and bromo-derivatives, Trans., 664.

—— some properties of calcium chloride solutions. I. Freezing points. II. Heats of dissolution. III. Densities, ii, 208.

Pictet, *Amé*, and *H.* **Barbier**, 2′-phenylquinoline, i, 481.

Pictet, *Amé*, and *Pierre* **Crépieux**, constitution of nicotine, phenylpyrroline, and pyridylpyrroline, i, 627.

Pictet, *Raoul*, freezing points of some carbon compounds, i, 272.

—— influence of low temperatures on the laws of crystallisation, ii, 42.

—— freezing point of sulphuric acid solutions, ii, 106.

—— frigotherapy, ii, 123, 253.

—— freezing points of mixtures of alcohol and water, ii, 155.

—— critical temperature of liquids holding solids in solution, ii, 201.

—— radiation at low temperatures, ii, 253, 277.

Pictet, *Raoul*, and *Michael* **Altschul**, critical temperatures as a test of the purity of liquids, ii, 200.

—— —— freezing point of liquid mixtures, ii, 204.

Picton, *Harold.* See *S. E.* **Linder.**

Piepenbrink, *P.* See *P.* **Jacobson.**

Pigeon, *Leon*, platinous chloride and its compounds, ii, 357.

Pigorini, *Pio*, paramercuriodiethylaniline, i, 359.

Pinner, *Adolf*, nicotine, i, 116, 308, 628.

—— imido-ethers, i, 264.

—— addition of bromine to tetrolic acid, i, 591.

Pinner, *Adolf*, and *N.* **Caro**, action of hydrazine on imido-ethers, i, 136.

—— —— action of hydrazine on furfurimido-ether, i, 270.

Pinnow, *Johannes*, tetramethyldiamidodiphenylmethane, i, 98.

Pinnow, *Johannes*, and *E.* **Müller**, reduction of orthonitrobenzonitrile, i, 212.

Piutti, *Arnoldo*, molecular asymmetry and rotatory power of organic substances, ii, 1.

Plimpton, *Richard, T.*, and *John C.* **Chorley,** titration of iodine solutions with barium thiosulphate, Trans., 314.

Plöchl, *Josef.* See *W. v.* **Miller.**

Plugge, *Pieter C.*, identity of sophorine and cytisine, i, 159.

—— cytisine and ulexine, i, 254.

Poda, *Enrico.* See *K.* **Zulkowski.**

Pohl, *E.* See *A.* **Salomon.**

Pohl, *Julius*, poisonous constituents of *Œnanthe crocata*, and of *Cicuta virosa*, i, 680.

Pokorný, *Joseph*, manufacture of orthonitraniline, i, 413.

Pollak, *Felix*, ethylic nicotinate and β-amidopyridine, i, 391.

Pollak, *Fritz*, synthetical formation of mesotartaric acid and racemic acid, i, 21.

Pollak, *J.* See *J.* **Herzig.**

Pollard, *William.* See *K.* **Seubert.**

Pomeranz, *Cæsar*, phenyl derivatives of glycollic aldehyde, i, 360.

Ponsot, *A.*, relation between the vapour pressures of a substance in the solid and liquid state, ii, 104.

—— reduction of the freezing point of dilute solutions of sodium chloride, ii, 206.

—— cryosalts, ii, 438.

Ponzio, *Giacomo*, isoundecylamine, i, 324.

Ponzio, *Giacomo.* See also *M.* **Fileti.**

Pope, *William J.*, orthobenzoic sulphinide, Trans., 985.

—— the crystalline form of the isomeric dimethylpimelic acids, Proc., 1895, 8.

Pope, *William J.* See also *F. S.* **Kipping.**

Porschnew, *G.* See *G.* **Lunge.**

Portmann, *B.* See *C.* **Hell.**

Posner, *Theodor.* See *S.* **Gabriel.**

Posth, *Wilhelm.* See *R.* **Anschütz** and *J.* **Bredt.**

Potilitzin, *Alexei, L.*, solubility of anhydrous calcium sulphate, ii, 350.

Power, *Frederick B.*, and *Clemens* **Kleber,** composition of American peppermint oil, ii, 295.

Prati, *Ugo*, the formation of oximes, ii, 259.

Pratt, *Julius H.*, double halogen salts of cæsium, rubidium, sodium, and lithium with thallium, ii, 398.

Prelinger, *O.*, nitrogen compounds of manganese, ii, 16.

Prentice, *David.* See *G. G.* **Henderson.**

Prianischnikow, *Dm.*, germinating process in *Vicia sativa*, ii, 124.

Přibram, *Richard*, burner for monochromatic (sodium) light, ii, 345.

—— simple percolator, ii, 345.

Přibram, *Richard*, and *Carl* **Glücksmann,** preparation of α-naphtholdithiocarboxylic acid, i, 379.

Pringsheim, *Nathanael*, precipitates in gelatinous solutions, ii, 491.

Prior, *George T.*, fergusonite from Ceylon, ii, 22.

Prior, *George T.*, and *Leonard J.* **Spencer,** augelite, ii, 507.

Prior, *George T.* See also *E.* **Hussak.**

Přiwoznik, *Ed.*, remarkable change of structure in glass when heated, ii, 447.

Proost, *W. F.*, separation of the dihydrophthalic acids, i, 141.

Prove, richness of soil in nitrogen after cultivation of various plants, ii, 178.

Prud'homme, *Maurice*, coloured sulphonic derivatives of triphenylmethane series, i, 423, 539.

—— ceruleïn, i, 424.

Prytz, *K.*, and *H.* **Holst,** absorption coefficients of carbonic anhydride and hydrogen sulphide in water at the freezing point, ii, 104.

Puchner, *H.*, estimation of dry matter in peat, ii, 544.

Pum, *Gustav*, action of water on trihydriodocinchonine, i, 76.

—— action of hydriodic acid on cinchotine and on hydroquinine, i, 403.

Pupin, *M. I.*, automatic vacuum pump, ii, 311.

Purdie, *Thomas*, and *Herbert W.* **Bolam,** ethereal optically active methoxysuccinic and propoxysuccinic acids, Trans., 944.

Purdie, *Thomas*, and *J. Wallace* **Walker,** preparation of the active lactic acids, and the rotation of their metallic salts in solution, Trans., 616.

Purdie, *Thomas*, and *Sidney* **Williamson,** ethereal salts of active methoxysuccinic and ethoxysuccinic acids, Trans., 957.

Purgotti, *Attilio*, derivatives of 2 : 4-dinitrophenylhydrazine and picrylhydrazine, i, 27.

—— synthesis of aromatic hydrazine derivatives from hydrazine hydrate, i, 275.

—— reduction of amidonitriles, i, 345.

—— action of hydrazine hydrate on benzylidenecyanhydrin, i, 602.

Purjewicz, *K.*, formation and decomposition of organic acids in higher plants, ii, 126.

Pusch, *August*, diphenacylacetic acid and its reduction products, i, 666.
—— a brominated bye-product of the preparation of diphenacylacetic acid, i, 666.

Q.

Quinquaud, *Ch. Eugène*, urea in the blood, ii, 299.

R.

Rabaut, *Ch.*, benzenesulpho-orthotoluidide and its derivatives, i, 595.
Radenhausen, *Rudolf*, combination of sugars with primary hydrazines, amidoguanidine, and arabinose, i, 409.
Radziewanowski, *Cornelius*, nature of the aluminium chloride reaction, i, 129.
—— use of aluminium in the synthesis of aromatic hydrocarbons, i, 412.
Raikow, *P. N.*, detection and estimation of chlorine in presence of iodine, ii, 242.
—— separation of copper from cadmium, zinc, and nickel, ii, 246.
Raisin, *Miss C. A.* See *T. G.* **Bonney.**
Rake, *Bevan*, percentage of iron in the liver in *Aukylostomiasis*, ii, 56.
Ramage, *Hugh*. See *J.* **Reddrop.**
Rammelsberg, *Carl F.*, chemical nature of staurolite, ii, 51.
Ramsay, *William*, discovery of helium in clevite, Trans., 1107.
—— the critical state, ii, 6.
—— passage of hydrogen through a palladium septum, ii, 39.
—— complexity and dissociation of liquid molecules, ii, 40.
—— helium, a gaseous constituent of certain minerals, ii, 498.
—— gas showing the spectrum of helium, the reputed cause of D_3, one of the lines in the coronal spectrum, ii, 498.
Ramsay, *William*, and *Emily* **Aston**, molecular surface energy of ethereal salts, ii, 40.
—— —— molecular surface energy of mixtures of non-associating liquids, ii, 40.
Ramsay, *William*, *J. Norman* **Collie**, and *Morris W.* **Travers**, helium a constituent of certain minerals, Trans., 684.
Ramsay, *William*. See *E. C. C.* **Baly**, and *L.* **Mond.**
Ramsden, *W.*, coagulation of proteïd by mechanical means, i, 254.
Raoult, *François M.*, osmotic pressure phenomena between ether and methylic alcohol with different diaphragms, ii, 486.
Rassow, *Berthold*, stereoisomeric paraphenylhexahydrobenzoic acids, i, 97.
Ratz, *Florian*, cinchotenine, i, 403.
Raum, *Wilhelm*, new class of cyclic iodo-compounds from iodophenylacetic acid, i, 139.
Rayleigh, *Lord*, density of nitrogen, ii, 444.
Reckleben, *H.* See *C.* **Paal.**
Recoura, *Albert*, molecular changes in chromium hydroxide, ii, 501.
Reddrop, *Joseph*, and *Hugh* **Ramage**, volumetric estimation of manganese, Trans., 268.
Reid, *E. Waymouth*, heat production in glands, ii, 405.
Reiniger, **Gebbert**, and **Schall**, sodium press as modified by E. Beckmann, ii, 163.
Reinitzer, *Benj.*, notes on volumetric analyses, ii, 134.
Reis, *Moritz A. v.*, estimation of sulphur in iron, ii, 527.
Reissert, *Arnold*, derivatives of α-quinoquinoline, i, 244.
—— action of ethylic chloracetate on phenylhydrazine, i, 460.
Reitter, *Hans*, aconic acid, i, 128.
Reitter, *Hans*. See also *R.* **Anschütz.**
Reitzenstein, *Fritz*, action of reducing agents on metallic cyanides: compounds of organic bases with certain metallic salts, i, 121.
Remsen, *Ira*, two isomeric chlorides of orthosulphobenzoic acid, i, 472.
Remsen, *Ira*, and *Charles E.* **Coates**, action of aniline and of the toluidines on orthosulphobenzoic acid and its chloride, i, 472.
Remsen, *Ira*, and *E. P.* **Kohler**, action of aniline on the chlorides of orthosulphobenzoic acid, i, 473.
Remsen, *Ira*, and *A. P.* **Saunders**, separation of the two chlorides of orthosulphobenzoic acid, i, 474.
Renard, *Adolphe*, pine tar, i, 185, 294.
—— ozobenzene, i, 593.
Renauld, *Edm.* See *E.* **Bamberger.**
Rennie, *Edward H.*, a colouring matter from *Lomatia ilicifolia* and *L. longifolia*, i, Trans., 784.
Retgers, *Jan W.*, preparation of hydrogen phosphide, ii, 13.

Retgers, *Jan W.*, mineralogical and chemical composition of the sand of the dunes of Holland, ii, 117.
—— isomorphism, ii, 160, 309.
Reverdin, *Frédéric*, preparation of 1 : 4-naphtholsulphonic acid, i, 151.
Reychler, *Albert*, essence of Ylang-ylang, i, 243, 294.
—— essence of cananga, i, 425, 551.
—— constitution of silver ammonia compounds, ii, 222.
Rhode, *Georg*. See *W. v.* **Miller.**
Richards, *Theodore W.*, atomic weight of strontium, ii, 314.
Richards, *Theodore W.*, and *George* **Oenslager**, cuprammonium double salts, i, 330.
Richards, *Theodore W.*, and *Harry G.* **Parker**, the inclusion of barium chloride by barium sulphate, ii, 370.
Richards, *Theodore W.*, and *Andrew H.* **Whitridge**, cuprammonium double salts, i, 329.
Riche, *Alfred*, and *Georges* **Halphen**, analysis of petroleums, ii, 90.
Richmond, *H. Droop*, the milk of the gamoose, Proc., 1895, 77.
—— Maumené's test for oils, ii, 427.
Richmond, *H. Droop*, and *L. Kidgell* **Boseley**, detection of formalin, ii, 426.
Riddle, *W.* See *V.* **Meyer.**
Riegler, *E.*, detection and estimation of albumin in urine, ii, 542.
Riet, *Berthault de St. J. van der*, chlorinated succinic acids and chloromaleïc acid, i, 19.
Riggs, *Robert B.*, qualitative separation of chromium from iron and aluminium, ii, 88.
Rimbach, *Eberhard*, dissociation and the optical rotation of active compounds, ii, 301.
Rimini, *E.* See *A.* **Angeli.**
Ringer, *Sydney*, and *Arthur G.* **Phear**, influence of saline media on tadpoles, ii, 239.
—— —— influence of saline media on *Tubifex rivulorum*, ii, 239.
Ripper, *M.*, estimation of iron in the ash of vegetable or animal matter, ii, 89.
Ris, *Christopher*, constitution of safranines, i, 148.
Ristori, *E.* See *W.* **Macnab.**
Rivals, *Paul*, acid chlorides and chloraldehydes, ii, 254.
—— chloraldehydes, ii, 306.
—— crystallised polymeride of chloraldehyde, ii, 307.
—— phthalic chloride and phthalide, ii, 483.
Rivals, *Paul.* See also *M.* **Berthelot.**
Roberts, *Charlotte F.*, standardising potassium permanganate, ii, 88.
Roberts, *Leslie*, physiology of the *Trichophytons*, ii, 457.
Robineau, *Fernand*, and *G.* **Rollin**, carbon tetriodide, tetrabromide, and tetrachloride, i, 123.
—— presence of ammonia in zinc powder, ii, 109.
Robinson, *H. L.*, vanadium in commercial caustic soda, ii, 49.
Robitscheck, *Wilhelm*, peptone in urine, ii, 25.
Rodewald, *H.*, steeping ("quellung") of starch, i, 165.
Rodger, *James W.*, and *W.* **Watson**, magnetic rotation of the plane of polarisation of light in liquids. Part I. Carbon bisulphide and water, ii, 474.
Roedel, *Sebastian.* See *R.* **Fittig.**
Röder, *Ludwig.* See *H.* **Goldschmidt.**
Roegglen, *Hugo.* See *M.* **Busch.**
Röhmann, *Franz*, glucase, ii, 52.
Röhmann, *Franz*, and *Wilhelm* **Spitzer**, oxidising action of animal tissue, ii, 234.
Roesler, *Leonhard*, analyses of Austro-Hungarian sweet wines, ii, 465.
Roessler, *Friedrich*, synthesis of minerals and analogous metallic compounds by crystallisation from molten metals, ii, 390.
Röttgen, *A.* See *P.* **Jannasch.**
Rohrer, *Rudolf.* See *K.* **Seubert.**
Roithner, *Ernst*, ethylenic oxide, i, 319.
Rokitianski, *F.*, maize meal fat, i, 501.
Rollin, *G.* See *F.* **Robineau.**
Roloff, *Max*, cryohydrates, ii, 438.
Romburgh, *Pieter van*, compounds of symmetrical trinitrobenzene, i, 652.
—— essence of roots of *Polygalæ* from Java, ii, 364.
—— volatile principles of coca leaves from Java, ii, 365.
Roode, *Rudolf de*, estimation of phosphoric acid by the molybdic acid-magnesia process, ii, 414.
—— estimation of potash in kainite, ii, 417.
Roos, *Ernst*, influence of the thyroid gland on metabolism, ii, 516.
Roozeboom, *Hendrik W. Bakhuis*, graphical representation of heterogeneous systems, ii, 72.
Roozeboom, *Hendrik W. Bakhuis*, and *Frans A. H.* **Schreinemakers**, equilibrium between liquid and solid phases, ii, 158.
Roques, *Ferdinand*, cinchonine, i, 688.

Roques, *Ferdinand*, an alcoholate of calcium bromide, ii, 390.

Rose, *Eduard*. See *P.* **Jannasch.**

Rose, *Tom K.*, note on the liquation in crystalline standard gold, Trans., 552.

—— the dissociation of chloride of gold, Trans., 881.

—— some physical properties of the chlorides of gold, Trans., 905.

Rosenheim, *Arthur*, salts of sulphomolybdic acid, ii, 18.

Rosenstiehl, *Auguste*, hexamethyltriamidotriphenylmethane derivatives, i, 377, 476.

—— constitution of acid magenta, i, 540.

—— oxidation products of tetramethyldiamidodiphenylcarbinol, i, 541.

—— instability of tetramethyldiamidodiphenylcarbinol, i, 541.

—— basic properties of the rosanilines, and their sulphonated derivatives, i, 667.

—— constitution of the rosanilines, i, 667.

Rosenzweig, *J.* See *O.* **Hinsberg.**

Roser, *Wilhelm*, constitution of the so-called quinoline ammonium bases, i, 155.

Roszkowski, *Jan*, polarisation. I. Solid cathodes, ii, 67.

—— polarisation. II. Liquid cathodes, ii, 67.

Rothenburg, *R. v.*, synthesis in the pyrazole series, i, 302, 686.

—— pyridazolones, i, 302.

—— isomerism in the pyrazole series, i, 303, 571.

—— antipyrine patents, i, 432.

—— phthaleïn melts, i, 538.

—— constitution of *n*-phenylpyrazolones, i, 570.

—— chemical equivalence, i, 571.

—— synthesis of antipyrine, i, 571.

Rothmund, *Victor*, potential differences between metals and electrolytes, ii, 35.

Rothrock, *I. R.* See *F. B.* **Dains.**

Rouffaer, *H. A.* See *A. P. N.* **Franchimont.**

Rousset, *L.*, paradimethylamidobenzylic alcohol, i, 176.

—— paramidoacetophenone and paramidophenylmethylcarbinol, i, 177.

—— mixed anhydrides, i, 592.

—— piperonylideneacetone, i, 601.

Rousset, *L.* See *L.* **Bouveault.**

Rouvier, *Gaston*, combination of iodine with potato starch, i, 587.

Royse, *J. S.* See *W. A.* **Noyes.**

Rudewitsch, *W.* See *N. D.* **Zelinsky.**

Rudolphi, *Max*, heats of solution and dissociation, ii, 435.

—— calculation of affinity constants, ii, 490.

Rügheimer, *Leopold*, and *W.* **Kronthal**, benzylquinoline, i, 481.

Ruhemann, *Siegfried*, and *Robert S.* **Morell**, ethylic amidoethylenedicarboxylate, i, 20.

—— —— constitution of pyrazolones, i, 432.

Ruhemann, *Siegfried*, and *K. J. P.* **Orton**, studies in the malonic acid series, Trans., 1002.

—— —— derivatives of citrazinamide: configuration of aconitic acid, i, 157.

Ruhemann, *Siegfried*, and *Annie P.* **Sedgwick**, ethylic dicarboxyglutaconate, i, 334.

Ruizand, *L.*, discrimination between lactose and glucose in adulterated peptones, ii, 424.

Runge, *Paul*. See *H. v.* **Pechmann.**

Rupe, *Hans*, imidazolones and their decomposition products, i, 218, 400.

Rupe, *Hans*, and *Georg* **Heberlein**, action of phenylhydrazine on chloracetanilide, i, 521.

Rupe, *Hans*, and *Felix* **Schneider**, α-halogenised ketones, i, 361.

Russell, *O. F.* See *F. S.* **Kipping.**

S.

Sabatier, *Paul*, hydrated metallic chlorides, ii, 226.

Sabatier, *Paul*, and *J. B.* **Senderens**, action of nitrous oxide on metals and metallic oxides, ii, 312.

—— —— reduction of nitric oxide by moist iron or zinc, ii, 445.

—— —— reduction of nitrous oxide by metals in presence of water, ii, 495.

Sachsse, *Robert*, and *Arthur* **Becker**, estimation of free ferric oxide in soil, ii, 293.

Salkowski, *Ernst L.*, carbohydrates of yeast, i, 166.

—— combination of sulphur in albumin, i, 255.

—— estimation of uric acid and xanthine compounds in urine, ii, 538.

Salkowski, *Ernst L.*, and *Martin* **Hahn**, behaviour of the phosphorus of caseïn in peptic digestion, ii, 119.

Salkowski, *Heinrich*, ethereal salts of amido-acids, i, 602.

Salomon, *A.*, and *E.* **Pohl,** action of hydrazines on ethylic ethanetetracarboxylate, i, 508.
Salvadori, *R.* See *F.* **Anderlini.**
Salzer, *Theodor*, sodium pyrophosphates, ii, 14.
—— water of crystallisation, ii, 488.
Sanctis, *G. de*, existence of coniine in *Sambucus nigra*, i, 433.
Sandmeyer, *W.*, paranucleïn in the animal organism, ii, 519.
Sauer, *Ewald*, a new shaking and stirring apparatus, ii, 216.
Saunders, *A. P.* See *I.* **Remsen.**
Scacchi, *Eugenio*, crystallography of the phenylnitrocinnamic acids and their derivatives, i, 533.
Schäfer, *Edward A.*, coagulation of fibrinogen, ii, 235.
Schäfer, *Edward A.*, and *George* **Oliver,** physiological action of extract of suprarenal capsules, ii, 405.
—— —— physiological action of extract of pituitary body, ii, 405.
Schäfer, *Edward A.* See *G.* **Oliver.**
Schäfer, *Julius.* See *R.* **Meyer.**
Schäffer, *E.* See *O.* **Fischer.**
Schär, *Ed.*, hyposulphurous acid, ii, 9.
Schaffer, *M.*, estimation of acidity in milk, ii, 94.
—— application of gas analysis to cheese making, ii, 148.
Schall, *Carl*, space isomerism of carbodiphenylimide and carboditolylimide, i, 42.
Schall. See **Reiniger.**
Scharfenberg, *O.* See *O.* **Wallach.**
Scharff, *Max.* See *P.* **Duden.**
Schattenfroh, *Arthur*, pumpkin oil, ii, 374.
Schattenfroh, *Arthur.* See also *H.* **Fresenius.**
Scheiding, *Fr.*, analytical communications, ii, 290.
Schenck, *Fr.*, sugar in the blood after bleeding, ii, 24.
Schenck, *Rudolf*, pulvamic acid and ethereal salts of pulvic acid, i, 100.
Scherbatscheff. See *N.* **Békétoff.**
Schestakow, *P.* See *C.* **Graebe.**
Scheuch, *F. C.* See *W. E* **Stone.**
Schiff, *Hugo*, triacetylgallic acid, i, 368.
—— indirect methods of analysis ii, 32.
Schiff, *Robert*, preparation of thioacetic acid and its application in chemico-legal investigations, ii, 370.
Schiff, *Robert*, and *N.* **Tarugi,** thioacetic acid as a substitute for hydrogen sulphide in qualitative analysis, ii, 84.
Schiller-Wechsler, *Max*, thio-derivatives of β-naphthol, i, 150.
Schimmell and Co., quantitative testing of ethereal oils, ii, 333.
—— essential oils, ii, 540.
Schimpff, *W.*, sylvanite from Stassfurt, ii, 504.
Schjerning, (*N. C.*) *Henrik*, the amorphous nitrogenous organic compounds in beer wort, ii, 428.
Schloesing, (*J. J.*) *Théophile*, loss of nitrogen in drainage waters, ii, 286.
Schloesing, *Th.*, *jun.*, germination of seeds, ii, 521.
Schlumberger, *Ernest*, aluminium compounds, ii, 353.
Schmidt, *Ernst*, scopolamine, i, 158.
—— choline, i, 200.
Schmidt, *F. W.*, double salts of silver and mercury containing cyanogen, i, 581.
—— a new oxysulphide of tin, ii, 19.
Schmidt, *G. C.*, absorption, ii, 39.
Schmidt, *G. C.* See also *E.* **Wiedemann.**
Schmidt, *Heinrich.* See *O.* **Fischer.**
Schmidt, *L.* See *M.* **Conrad.**
Schmidt, *Max.* See *T.* **Zincke.**
Schmidt, *Paul F.*, products of the reduction of oxalyldiacetophenone, i, 464.
Schmidt, *R.* See *F.* **Tiemann.**
Schmidt, *Raymund.* See *F.* **Stohmann.**
Schmied, *H.* See *A.* **Kossel.**
Schmiedeberg, *O.*, ferratin: its dietetical and therapeutical employment, i, 196.
Schmitt, *F.* See *P.* **Jannasch.**
Schmitz, *K.* See *K.* **Elbs.**
Schmitz, *P.* See *E.* **Baumann.**
Schneegans, *August*, and *Emil* **Bronnert,** ilicene, i, 182.
Schneegans, *August*, and *J. E.* **Gerock,** Gaultherin, a new glucoside from *Betula lenta*, i, 109.
Schneider, *Bernh. v.* See *M.* **Altschul.**
Schneider, *Edward A.*, colloïdal silver, ii, 45.
—— action of phosphorus trichloride on magnesium nitride, ii, 46.
—— methods of removing phosphoric acid or alkali phosphates from the phosphates of calcium and iron, ii, 112.
—— action of dry hydrogen chloride on serpentine, ii, 166.
—— titanium, ii, 169.
—— detection of potassium cyanate in potassium cyanide, ii, 424.
Schneider, *Felix.* See *H.* **Rupe.**

Schneider, *Josef*, estimation of indigotin, ii, 468.
Schneider, *Leopold*, chemical investigation of steel, ii, 292.
—— estimation of carbon in iron, ii, 531.
Schneider, *R.*, atomic weight of bismuth, ii, 114.
Schöfer, *G.* See *T.* **Curtius.**
Schönrock, *Otto*, magnetic rotation of solutions of hydrogen chloride, ii, 196.
Schönrock, *Otto.* See *H.* **Jahn.**
Schöpff, *Martin*, dihydrophenonaphthacridine and phenonaphthacridine, i, 107.
Scholl, *Roland*, chloro-formoxime, i, 81.
Scholl, *Roland*, and *Georg* **Born**, action of nitric peroxide on ketoximes, i, 445.
Scholtz, *Max*, piperic aldehyde, i, 464.
—— condensation products of piperonylacraldehyde and synthetical piperine derivatives, i, 468.
—— conversion of aliphatic oximes into pyridine derivatives, i, 562.
Scholtz, *Max.* See also *A.* **Ladenburg.**
Schon, *C. V.*, laboratory apparatus, ii, 215.
Schottländer, *Paul*, triammonium orthophosphate and the detection of magnesium, ii, 64.
—— colloïdal gold, ii, 318.
Schrader, *F.* See *T.* **Curtius.**
Schreiber, *W.* See *P.* **Friedlaender.**
Schreinemakers, *Frans A. H.* See *H. W. B.* **Roozeboom.**
Schröder, *E.* See *H.* **Jahn.**
Schröter, *Paul.* See *R.* **Nietzki.**
Schütz, *Emil.* See *A.* **Arzruni.**
Schützenberger, *Paul*, cerite metals, ii, 352, 393, 448.
Schuftan, *Adolf*, antipyrine derivatives, i, 482.
Schulte, *J.*, effect of chlorides on vegetation and on the amount of starch in potatoes, ii, 61.
Schultz, *K.* See *A.* **Töhl.**
Schulze, *Bernhard*, analyses of Silesian soils, ii, 178.
Schulze, *Ernst*, glutamine in the green parts of plants, ii, 83.
—— crystalline nitrogenous compounds in seedlings, ii, 84.
—— estimation of carbohydrates, ii, 94.
—— estimation of lecithin in plants, ii, 96.
—— analysis of seeds, ii, 192.
Schulze, *Ernst*, and *S.* **Frankfurt**, β-levulin, i, 165.
Schulze, *Ernst*, and *S.* **Frankfurt**, cane sugar in plants, ii, 523.
Schulze, *Ernst*, *S.* **Frankfurt**, and *Ernst* **Winterstein**, the organic bases of some agricultural seeds, oil-cakes, tubers, and of some seedlings, ii, 364.
Schulze, *Otto W.* See *A.* **Hantzsch.**
Schunck, *Edward*, the yellow colouring matter of *Sophora japonica*, Trans., 30.
—— chlorophyll, i, 624.
Schunck, *Edward*, and *Leo* **Marchlewski**, carminic acid, i, 67.
—— —— naphthazarin and the formation of naphthocyamic acid, i, 150.
—— —— the red isomeride of indigotin: derivatives of isatin, i, 288.
—— chlorophyll, i, 296.
Schwan, *Nicolaus.* See *T.* **Curtius.**
Schwarz, *Fritz*, new polyphosphoric acid, $H_5P_3O_{10}$, and its salts, ii, 445.
Schweitzer, *H.*, and *E.* **Lungwitz**, new process for estimating potassium, ii, 245.
Schwicker, *Alfred*, reaction velocity of potassium hypoiodite, ii, 213.
Schwickerath, *K.* See *R.* **Anschütz.**
Schwiening, *Heinrich*, influence of certain proteïds on solutions of glycogen, i, 124.
Schwimmer, *M.* See *J.* **Finckh.**
Scoccianti, *L.* See *A.* **Monari.**
Sebelein, *John*, digestion of pseudonucleïn from caseïn, ii, 278.
Sedgwick, *Annie P.*, and *J. Norman* **Collie**, some oxypyridine derivatives, Trans., 399.
Sedgwick, *Annie P.* See also *S.* **Ruhemann.**
Seegen, *Josef*, sugar and muscular work, ii, 233.
Seelemann, *Alex.* See *A.* **Claus.**
Segalle, *R.*, volumetric estimation of phosphoric acid, ii, 184.
Seldner, *R.*, gluatarimide, i, 591.
Semmler, *Friedrich W.*, optically active terpineol, i, 675.
Semmler, *Friedrich W.* See also *F.* **Tiemann.**
Senderens, *J. B.*, precipitation of metallic lead, ii, 315.
—— lead orthonitrate, ii, 316.
Senderens, *J. B.* See also *P.* **Sabatier.**
Serono, *C.*, pyroantimonious acid, ii, 231.
Sestini, *Fausto*, genuineness of basic slag, ii, 86.
—— Italian graphites, ii, 400.
—— graphitite from Monte Pisano, ii, 504.

Seubert, *Karl*, history of the periodic system, ii, 439.

Seubert, *Karl*, and *Karl* **Gaab**, action of ferric chloride on metallic iodides, ii, 395.

Seubert, *Karl*, and *William* **Pollard**, acidimetric estimation of molybdic acid, ii, 331.

—— —— atomic weight of molybdenum, ii, 356.

Seubert, *Karl*, and *Rudolf* **Rohrer**, action of ferric sulphate on potassium iodide and hydriodic acid, ii, 17.

—— —— action of ferric acetate on potassium iodide and hydrogen iodide, ii, 111.

Seubert, *Karl*. See also *L.* **Meyer.**

Seyda and **Woy**, detection of magarine in butter, ii, 145.

Seyewetz, *Alphonse*, and *G.* **Chicandard**, sodium thiosulphate in photography, ii, 349.

Seyewetz, *Alphonse*. See *A.* **Lumiere.**

Seyler, *C. A.*, estimation of carbonates and caustic alkalis in mixtures, ii, 64.

Shaw, *Saville*. See *P. P.* **Bedson.**

Shields, *John*. See *L.* **Mond.**

Shimer, *Porter W.*, estimation of zinc, ii, 291.

Shiver, *F. S.*, standardising sulphuric acid, ii, 413.

Shober, *W. B.*, and *H. E.* **Kiefer**, action of alcohols on metadiazobenzenesulphonic acid, i, 520.

Shukoff, *A.*, coloured alkaline solutions of 1 : 3 : 5-dinitrobenzoic acid, i, 530.

Siegfried, *Max A.*, carnic acid, i, 76.

—— phosphorcarnic acid, i, 313.

Silber, *Paul*. See *G. L.* **Ciamician.**

Silberstein, *Alfred*. See *R.* **Fittig.**

Simon, *Louis*, rotatory powers of amylic pyruvate and lactate, i, 333.

—— conversion of an aniline salt into an anilic acid, i, 594.

Sinclair, *W.* See *A. W.* **Bishop.**

Sisley, *Paul*, acetylgallic and acetyldibromogallic acids, i, 283.

—— triacetylgallic acid, i, 420.

Sjögren, *S. A. Hjalmar*, svabite and adelite, ii, 22.

—— urbanite, a new pyroxene, ii, 513.

Sjöström, *O. A.*, neptunite, ii, 402.

Skinner, *Sidney*, Clark cell when producing a current, ii, 34.

Skraup, *Zdenko H.*, constitution of the additive compounds of the cinchona alkaloïds with ethylic iodide, i, 75.

—— cinchotenine, i, 254.

—— cinchonine and cinchotenine, i, 483.

—— relative affinities of organic bases in alcoholic solution, ii, 259.

Smale, *Fred. J.*, gas batteries, a correction, ii, 251.

Smith, *Claud*. See *C. F.* **Cross.**

Smith, *Edgar F.*, and *Henry C.* **Burr**, attempt to prepare molybdenum hexachloride, ii, 18.

Smith, *Edgar F.*, and *En. D.* **Desi**, atomic weight of tungsten, ii, 230.

Smith, *Edgar F.* See also *H.* **Fleck**, *A. W.* **Grodspeed**, *J. G.* **Hibbs**, *M.* **Pennington.**

Smith, *William J.*, formation of sulphuric acid in the organism, ii, 25.

Smithells, *Arthur*, on flame temperatures and the acetylene theory of luminous hydrocarbon flames, Trans., 1049.

Söderbaum, *Henryk G.*, heterocyclic bases from hydroxydiphenylethylamine, i, 596.

Solberg, *E.* See *F. H.* **Werenskiold.**

Soldaini, *Arturo*, alkaloïds of *Lupinus albus*, i, 311.

Sollas, *William J.*, zinnwaldite from Mourne Mountains, co. Down, ii, 512.

—— garnet hornfels from co. Dublin, ii, 514.

—— the Leinster granites, ii, 515.

Sommer, *E. A.*, action of nitrous acid on cinnamene, i, 456.

Sonnenfeld, *E.* See *A.* **Werner.**

Sonstadt, *Edward*, note on the reduction of potassium platinochloride, Trans., 984.

Spatzier, *W.*, occurrence and rôle of myosin in plants, ii, 178.

Spencer, *Leonard J.* See *G. T.* **Prior.**

Spenzer, *John G.* See *R.* **Fittig.**

Spica, *Matteo*, detection of salicylic acid in wines, ii, 426.

Spieckermann, *A.*, stearoxylic and behenoxylic acids, i, 208.

Spirgatis, *H.*, scammony resin, i, 109.

Spiro, *Karl*. See *I.* **Fraenkel.**

Spitzer, *Wilhelm*, glycolysis in blood and tissues, ii, 361.

Spitzer, *Wilhelm*. See also *F.* **Röhmann.**

Spring, *Walthère*, fluidity of metals at temperatures below their melting points, ii, 37.

—— conversion of black mercuric sulphide into the red modification: density and specific heat of the two forms, ii, 110.

—— colour, specific gravity, and surface tension of hydrogen peroxide, ii, 346.

—— specific heat of hydrogen peroxide, ii, 377.

Spüller, *Jos.*, and *S.* **Kalman**, estima-

tion of sulphur in pig iron and steel, ii, 244.
Staats, *Georg*, fresh discovery of gypsum crystals, ii, 76.
Stabil, *C.* See *E.* **Burcker.**
Stadt, *E. van de.* See *W. J.* **Jorissen.**
Staedel, *Wilhelm*, symmetrical orthodiamidobenzophenone, i, 147.
—— constitution of isomeric symmetrical di-derivatives of diphenylmethane and of benzophenone, i, 232.
—— isomeric dinitrodiphenylmethane derivatives, i, 232.
—— dinitro-, diamido-, and dihydroxy-derivatives of benzophenone, i, 233.
—— hydroxydiphenylene ketones and hydroxydiphenylcarboxylic acids, i, 233.
Stahl, *E.*, transpiration and assimilation, ii, 175.
Stange, *Otto.* See *J.* **Thiele.**
Stanojewitsch, *Duschan*, estimation of nitrogen in nitro-cellulose, ii, 243.
Starling, *Ernest H.* See *J. B.* **Leathes.**
Stavenhagen, *Alfred*, the arsenites, ii, 217.
Steen, *Olav*, separation of bismuth from lead, ii, 536.
Stein, *Otto*, paradiamidodiphenylmethanesulphone, i, 54.
Stein, *V.*, effect on butter of feeding with sesame and cotton cakes, ii, 299.
Steinitz, *Jacob.* See *A.* **Claus.**
Stellwaag, *August.* See *C.* **Krauss.**
Stelzner, *Alfred W.*, zinckenite from Oruro, in Bolivia, ii, 171.
Stern, *Arthur L.*, contributions to the chemistry of cellulose. I. Cellulose-sulphuric acid and the products of its hydrolysis, TRANS., 74.
Stieglitz, *Julius*, action of sodium ethoxide on carbodiphenylimide, i, 277.
Stieglitz, *Julius.* See *F.* **Lengfeld.**
Stiepel, *K.* See *R.* **Anschütz.**
Stobbe, *Hans*, synthesis of unsaturated dicarboxylic acids from ketones and diethylic succinate, i, 142.
—— condensation of ketones with ethylic salts of dibasic acids under the influence of sodium ethoxide, i, 410
Stock, *August.* See *E.* **Beckmann.**
Stoehr, *Carl*, pyrazines and piperazines, i, 569.
Stoermer, *Rich.*, action of chloracetone on sodium phenoxide and synthesis of cumarone derivatives, i, 464.
Stoermer, *Rich.*, and *O.* **Burkert**, piperidylacetal, i, 479.
—— —— piperidylacetone, i, 479.
Stoermer, *Rich.*, and *O.* **Dzimski**, di-substituted amidoacetones, i, 681.
Stohmann, *Fr.*, heat value of nutritive substances, ii, 51.
Stohmann, *Fr.*, and *Heinrich* **Langbein**, thermochemistry of the isomeric acids of the composition $C_7H_6O_3$ and $C_8H_8O_3$, ii, 102.
Stohmann, *Fr.*, and *Raymund* **Schmidt**, heat of combustion of glycogen, ii, 102.
—— —— calorimetric investigations: heat equivalents of the amides and anilides of monobasic acids, ii, 482.
Stokes, *Henry N.*, phosphorus chloronitride, ii, 217.
Stokes, *Henry N.* See also *L. G.* **Eakins.**
Stoklasa, *Julius*, the compounds of phosphoric acid in superphosphates soluble in water, ii, 131.
—— chemical investigations in plant pathology, ii, 524.
Stolz, *Friedrich*, antipyrine, i, 394.
—— 1 : 3 : 5-parethoxyphenylmethylethoxypyrazole, i, 398.
—— pyrazolone, i, 624.
Stone, *Winthrop E.*, action of ammonia on *d*-glucose, i, 320.
—— comparison of methods for the estimation of starch, ii, 189.
—— carbohydrates of the gum of *Acacia decurrens*, ii, 285.
Stone, *Winthrop E.*, and *Dumont* **Lotz**, sugar of the *Agave Americana*, ii, 363.
Stone, *Winthrop E.*, and *F. C.* **Scheuch**, estimation of calcium oxide in quicklime, ii, 186.
Stoney, *G. Johnstone*, motions of and within molecules: on the significance of the ratio of the two specific heats in gases, ii, 481.
Stortenbeker, *Willem*, mixed crystals of the chlorides of cobalt and nickel, ii, 209.
Stracciati, *Enrico.* See *A.* **Bartoli.**
Straus, *Paul*, copper and manganous cyanides, i, 485.
Streatfeild, *Frederick W.* See R. **Meldola.**
Strecker, *Karl*, electrical conductivity, ii, 252.
Struve, *G.*, benzhydrazide (benzoylhydrazine), i, 34.
Stutzer, *Albert*, estimation of the nitrogenous constituents of meat extract, ii, 543.
—— analysis of meat extracts and peptones, ii, 543.
Sudborough, *J. Joseph*, diortho-sub-

stituted benzoic acids. I. Substituted benzoyl chlorides, TRANS., 587.
Sudborough, *J. Joseph,* diortho-substituted benzoic acids, II. Hydrolysis of aromatic nitriles and acid-amides, TRANS., 601.
—— note on the action of sodium ethoxide on deoxybenzoin, TRANS., 604.
Sudborough, *J. Joseph.* See also *V.* **Meyer,** *W. H.* **Perkin,** jun.
Süvern. See *M.* **Gerlach.**
Sundwick, *Ernst E.,* uroxanic and oxonic acids, i, 129.
Surre. See *C.* **Fabre.**
Suter, *F.,* benzylcysteïn, i, 624.
—— mode of combination of sulphur in albumin, i, 691.
Swan, *J. W.,* some voltaic combinations with a fused electrolyte and a gaseous depolariser, ii, 66.
Syniewski, *Victor,* methylic carbonates from polyhydric phenols, i, 602.
Szymkiewicz, *F.* See *F.* **Krüger.**

T.

Tacke, *Bruno,* peculiar property of phosphoric acid in peaty soil, ii, 285.
Täuber, *Ernst,* pyridazine, i, 301.
Tafel, *Julius.* See *H.* **Günter.**
Tambach, *Rudolph,* thiohydantoïnacetic acid and diphenylthiohydantoïnacetic acid, i, 13.
Tammann, *Gustav,* volume change on neutralisation, ii, 204.
Tammann, *Gustav.* See also *K.* **Zepernik.**
Tanatar, *Simeon M.,* electrolytic dissociation, ii, 36.
Tanatar, *Simeon M., J.* **Choina,** and *D.* **Kozireff,** freezing point depressions in dilute alcoholic solution, ii, 41.
Tanret, *Charles,* pseudopelletierine, i, 254.
—— acetates derived from sugars, i, 321.
—— amorphous condition of fused substances, i, 408.
—— molecular modifications of glucose, i, 490.
Tardy. See *G.* **Bouchardat.**
Tarugi, *N.* nitrocamphor, i, 60.
—— preparation of thioacetic acid and its use in toxicology, ii, 415.
Tarugi, *N.* See also *R.* **Schiff.**
Tassilly, basic calcium salts, ii, 45.
—— thermal constants of calcium oxybromide and oxyiodide, ii, 304.
—— thermochemistry of barium and strontium iodides, ii, 342.
—— basic halogen salts of the alkaline earths, ii, 500.
Tassinari, *Gabriele,* thio-derivatives of β-naphthol, i, 150.
Taverne, *H. J.,* products of the hydrolysis of convolvulin and its composition, i, 119.
Techow, *Walter,* derivatives of dimethylalloxan, i, 83.
Teclu, *Nicolae,* flames, ii, 478.
Teichmann, *H.* See **C. Haeussermann.**
Tennille, *George F.,* the phosphomolybdic acid test in lard analysis, ii, 467.
Thaddéeff, *Konstantin,* certain regularities in the weights of drops of molten metals, ii, 161.
Thaddéeff, *Konstantin.* See also *A.* **Arzruni.**
Thezard, analysis of the bone of a mummy, ii, 456.
Thiele, *Edmund,* spectrophotometric researches on iodine solutions, ii, 193.
Thiele, *Edmund,* and *Hugo* **Weil,** benzylenimide, i, 523.
Thiele, *Johannes* and *Otto* **Dimroth,** indole from orthodiamido stilbene, i, 534.
Thiele, *Johannes* and *Otto* **Stange,** semicarbazide, i, 251.
Thiele, *Johannes,* and *L. H.* **Wheeler,** conversion of hydrazines into paradiamines, i, 520.
Thiele, *Johannes.* See also *O.* **Dimroth.**
Thörner, *Wilhelm,* gaseous products in milk, ii, 298.
Thomälen, *H.,* Rüdorff's process of electrolysis, ii, 139.
Thomas, *G. L.,* and *Sydney* **Young,** the vapour pressures, specific volumes, and critical constants of normal hexane, TRANS., 1071.
Thomas, *G. L.* See also *S.* **Young.**
Thomas, *V.,* combination of nitric oxide with ferric chloride, ii, 271.
—— action of nitric peroxide on antimony salts, ii, 450.
—— action of nitric oxide on metallic chlorides, ii, 495.
Thomas, *W. S.,* estimation of manganese, ii, 420.
Thomas-Mamert, *René,* amidofumarates, i, 267.
—— ethylic β-amidoanticrotonate, i, 448.
Thomsen, *Julius,* systematic arrangement of the elements, ii, 491.
Thomson, *Isaac W.,* detection and estimation of sodium in lithium salts, ii, 532.
Thomson, *Joseph J.,* electrolysis of gases, ii, 475.
Thomson, *J. Stuart.* See *M. F.* **Heddle.**
Thomson, *Robert T.,* preservative

value of formaldehyde and its detection in milk, ii, 373.
Thorpe, *Jocelyn F.* See *K.* **Auwers.**
Thugutt, *Stanislaus J.*, Aluminosilicates, ii, 358.
Thurmann, *H.* See *T.* **Pfeiffer.**
Tichomiroff, *M.*, precipitation of toxalbumins by nucleic acid, i, 692.
Tiemann, *Ferdinand*, camphor, i, 426.
—— bromophenylhydrazone and semicarbazide of *d*-camphor, i, 675.
—— campholene derivatives, i, 675.
Tiemann, *Ferdinand*, and *Paul* **Krüger**, ionone and irone, i, 530.
—— —— synthesis of an isoamylideneacetone, i, 645.
Tiemann, *Ferdinand*, and *R.* **Schmidt**, oxidation of terpin, terpin hydrate, and terpineol, i, 548.
—— —— conversion of *d*- and l-linalol and of geraniol into terpin hydrate, i, 639.
Tiemann, *Ferdinand*, and *Friedrich W.* **Semmler**, pinene, i, 477.
—— —— methoethylheptanonolide, i, 548.
—— —— natural methylheptenone (methyl isopropylidenepropyl ketone), i, 646.
—— —— oxidation of dihydrocarveol, and of limonene, i, 674.
Tiemann, *Ferdinand.* See also *F.* **Mahla.**
Tikhvinsky, *M.* See *F.* **Kehrmann.**
Tilden, *William A.*, and *Martin O.* **Forster**, action of nitrosyl chloride on amides, Trans., 489.
Tilden, *William, A.*, and *B. M. C.* **Marshall**, action of nitrosyl chloride on asparagine and aspartic acid. Formation of laevorotatory chlorosuccinic acid, Trans., 494.
Timiriazeff, *Clemenz A.*, protophyllin, natural and artificial, i, 389.
Timpe, *H.*, Soxhlet's areometric estimation of fat in milk, ii, 95.
Tischendorf, *P.*, action of phosgene on derivatives of sulphonic and sulphinic acids, i, 287.
Tissot, *J.*, gaseous exchange in isolated muscle, ii, 231.
Tittinger, *Emil*, solubility of precipitated sulphur in carbon bisulphide, ii, 261.
Töhl, *Albert*, opening of the thiophen ring by piperidine, i, 681.
Töhl, *Albert*, and *K.* **Schultz**, action of sulphuric acid on bromothiophens, i, 86.
Toepfer, *Gustav.* See *E.* **Freund.**
Toepler, *Max*, volume changes in elements during melting, ii, 5.
Tollens, *Bernhard*, lamp for the production of formaldehyde, ii, 161.
Tollens, *Bernhard.* See also *F.* **Mann.**
Tolloczko, *St.*, new application of the principle of the reduction of solubility to the determination of molecular weights, ii, 256.
Tolomei, *G.*, nitrifying ferment, ii, 83.
Tortelli, *Massimo*, constitution of rosanilines, i, 540.
Trachmann, *O.* See *T.* **Curtius.**
Traube, *Hermann*, chromite in lower Silesia, ii, 50.
—— davyn, ii, 50.
Traube, *Hermann.* See also *L.* **Bourgeois.**
Traube, *Isodor*, atomic and molecular solution volumes, ii, 70.
—— principles of a new system of the elements, ii, 72.
—— certain regularities in the weights of drops of molten metals, ii, 203.
—— method of determining molecular weight and constitution, ii, 209.
—— cause of osmotic pressure and ionisation (electrolytic dissociation), ii, 308.
—— molecular weight determinations of solid, liquid, and dissolved substances, ii, 308.
Traube, *Wilhelm*, isonitramines, i, 124.
—— isonitramine and oxazo-derivatives of fatty acids, i, 502.
Travers, *Morris W.* See *W.* **Ramsay.**
Trevor, *Joseph E.*, law of mass action, ii, 384.
Trevor, *Joseph E.*, and *Frederick L.* **Kortright**, chemical equilibria as temperature functions, ii, 211.
Trey, *Heinrich*, sensitiveness of zone reactions, and their use in testing for acids, ii, 135.
Troeger, *Julius*, reduction of solid α-dichlorethylic cyanide, i, 161.
Troeger, *Julius*, and *Paul W.* **Uhlmann**, oxidation of derivatives obtained by the action of ortho- and para-toluenesulphonic chloride on amido-compounds, i, 369.
Trubert, *Albert*, estimation of calcium and magnesium carbonates in soils, ashes, &c., ii, 245.
Trübsbach, *P. A.*, affinity constants of ureides and iso-nitroso-derivatives, ii, 310.
Tryller, *Heinrich.* See *R.* **Behrend.**
Tschermak, *Armin*, amyloid, i, 255.
Tschirch, *Alexander*, and *E.* **Aweng**, amber (succinite), i, 384.
Tsukamoto, *M.* See *O.* **Loew.**

U.

Uffelmann, *C.*, and *A.* **Bömer,** chemical composition of kola nuts, ii, 241.

Uhlmann, *Paul W.*, action of ethylic cyanacetate on mononitrodiazobenzene salts, i, 274.

Uhlmann, *Paul W.* See also *J.* **Troeger.**

Ulke, *T.*, new tin mineral from the Black Hills, ii, 21.

Ullik, *F.*, araban, i, 322.

Ullmann, *Carl*, apparatus for the assay of pyrolusite by Bunsen's process, ii, 88.

Ullmann, *F.* See *C.* **Graebe.**

Ullmann, *H. M.*, parachlorometasulphobenzoic acid and its derivatives, i, 181.

Ulzer, *Ferd.*, and *A.* **Friedrich,** estimation of chlorine in commercial iodine, ii, 136.

Ungar, *Oskar.* See *G.* **Krüss.**

Urbahn, *J.* See *A.* **Hantzsch.**

Uslar, *Carl v.*, separation of mercury from the metals of the arsenic and copper groups, ii, 532.

Utescher, *E.*, combination of benzaldehyde with hydrocyanic acid in dilute solution, i, 419.

V.

Vaillant, *Victor*, action of sulphur chloride on the copper derivatives of acetylacetone and benzaldehyde, i, 168.

Vanino, *Ludwig*, tables for the estimation of urea by Riegler's method, ii, 190.

—— titration of arsenious acid by permanganate, ii, 531.

Varet, *Raoul*, mercuric picrate, i, 131.

—— action of picric acid and picrates on metallic cyanides, i, 132.

—— mercuric sulphates, ii, 103.

—— mercuric nitrates, ii, 154.

—— heat of formation of mercuric salts, ii, 305.

—— isomeric mercuric oxides, ii, 305.

—— heat of combination of mercury with other elements, ii, 380.

—— heats of formation of mercurous sulphate, nitrate, and acetate, ii, 380.

—— heats of formation of mercurous chloride, bromide, iodide and oxide, ii, 381.

—— isomeric changes of mercury compounds, ii, 435.

Vaubel, *Wilhelm*, the benzene-nucleus, i, 53, 339.

—— action of nascent bromine on the triphenylmethane colouring matters, i, 55.

Vaubel, *Wilhelm*, the triphenylmethane colouring matters, i, 56.

—— action of nascent bromine on pyrroline, pyridine, and pyrazole, i, 68.

—— solubility of benzene derivatives in water, ii, 489.

Vaudin, *Lucien*, colostrum of the cow, ii, 81.

—— citric acid and calcium phosphate in milk, ii, 122.

Vay, *Franz*, ferratin and iron in the liver, ii, 173.

Vedrödi, *Victor*, estimation of nicotine and ammonia in tobacco, ii, 541.

Veen, *P. J. van der.* See *C. J. van* **Lookeren.**

Veley, *Victor H.*, the action of hydrogen chloride on the oxides of calcium, barium, and magnesium, Proc., **1894**, 240.

—— hydrate of nitric acid: action of nitric acid on organic compounds, ii, 262.

Venable, *Frank P.*, and *Thomas* **Clarke,** properties of calcium carbide, ii, 265.

Venator, *Wilhelm*, recovery of silver from solutions, ii, 500.

Verschaffelt, *J.*, pressure of solution as a means of determining the temperature of change, ii, 106.

Vignolo, *G.*, essence of *Cannabis indica*, i, 623.

Vignolo, *G.* See also *F.* **Marino-Zuco.**

Vigouroux, preparation of amorphous silicon, ii, 222.

—— amorphous silicon, ii, 263.

—— analyses of silicon, ii, 264.

—— reduction of silica by aluminium, ii, 447.

Villard, *P.*, acetylene and its hydrate, i, 635.

—— hydrate of carbonic anhydride: composition of gaseous hydrates, ii, 44.

—— dissolution of solids in vapours, ii, 255.

Villard, *P.*, and *R.* **Jarry,** solid carbonic anhydride, ii, 497.

Ville, *Jules*, and *Charles* **Astre,** action of amidobenzoic acid on quinone, i, 465.

—— —— quinone-bis-amidobenzoic acid, i, 533.

Villiers, *A.*, zinc and manganese sulphides and the protomorphic state, ii, 224.

—— metallic sulphides, ii, 227.

Villiers, *A.*, nickel and cobalt sulphides, ii, 228.
—— qualitative separation of nickel and cobalt, ii, 247.
—— transformations of zinc sulphide, ii, 266.
—— crystallisation of precipitates: zinc and manganese sulphides and copper hydroxide, ii, 267.
—— basic and acidic zinc sulphide, ii, 267.
Vincenzi, *Vittorio*, Königs and Lellmann's hydroquinoline, i, 69.
Vitali, *Dioscoride*, indirect volumetric analyses by means of sulphurous acid, ii, 140.
—— tests for distinguishing atropine from strychnine, ii, 467.
Vogel, *J.* See *E.* **Külz**, *W.* **Pautz.**
Vogt, *J. H. L.*, iron nickel pyrites from Norway, ii, 171.
Vogtherr, *M.*, *Randia dumetorum*, i, 189.
Voit, *Irwin*, and *Alexander* **Korkunoff**, nitrogenous metabolism, ii, 359.
Volhard, *Jakob*, synthesis and constitution of vulpic acid, i, 99.
—— improved laboratory apparatus, ii, 216.
—— lecture experiment: gain of weight in combustion, ii, 260.
Volhard, *Jakob* and *F.* **Henke**, derivatives of diphenylketipic dinitrile, i, 101.
Vorländer, *Daniel*, ethylenic salts of bibasic acids and phenols, i, 17.
Vortmann, *Georg*, electrolytic separation of iron and cobalt from zinc, ii, 89.
Vos, *François de.* See *R.* **Fittig.**
Vrba, *Carl*, phenacite from Ober-Neusattel, ii, 172.
—— beryl from Pisek, ii, 173.
Vulpius, *Gustav*, solubility of iodoform in alcohol and ether, i, 633.

W.

Waga, *Fritz*, magnesiumdiphenyl, i, 143.
Wagner, *Paul*, estimation of citrate-soluble phosphoric acid in basic slag and mineral phosphates, ii, 243.
Wakeman, *Alfred J.*, influence of electrolytes on the conductivity of acetic acid, ii, 68.
Walbaum, *Heinrich.* See *J.* **Bertram.**
Walden, *Paul*, constitution of ricinoleïc acid and its derivatives, i, 125.
—— optically active halogen derivatives, i, 450.
—— optical rotation of ions, ii, 65.
Walden, *Paul*, optical rotation of amyl derivatives, ii, 149.
Walden, *Paul.* See *C. A.* **Bischoff.**
Walden, *P. T.*, double chlorides and bromides of cæsium, rubidium, potassium, and ammonium with ferric iron: ferrosoferric double bromides, ii, 165.
Walker, *Cora*, chemical composition of two silver ornaments from Inca graves at Chimbote, Peru, Trans., 242.
Walker, *James*, and *Emily* **Aston**, affinity of weak bases, Trans., 576.
Walker, *James*, and *Frederick J.* **Hambly**, transformation of ammonium cyanate into urea, Trans., 746.
Walker, *James*, and *James* **Henderson**, electrolysis of potassium allocamphorate, Trans., 337.
—— —— estimation of halogens in organic compounds, ii, 326.
—— —— Carius-Volhard estimation of halogens, ii, 368.
Walker, *James.* See also *J. R.* **Appleyard.**
Walker, *J. Wallace*, the ethereal salts of the optically active lactic, chloropropionic, and bromopropionic acids, Trans., 914.
Walker, *J. Wallace.* See also *T.* **Purdie.**
Walker, *M. S.*, preparation of potassium ferricyanide, i, 197.
Wallach, *Otto*, terpenes and ethereal oils, i, 59.
—— hydroxymethylene compounds from ketones of the terpene series, i, 187.
—— fenchone, i, 380.
—— limonene nitrosochloride, i, 478, 546.
—— constitution of terpineol, i, 547.
—— terpenes and ethereal oils. Brominated derivatives of the carvone series, i, 621.
—— isomerism in the terpene series, i, 672.
Wallach, *Otto* (and, in part, *J. T.* **Conroy** and *O.* **Scharfenberg**), terpenes and ethereal oils: thujone derivatives, i, 619.
Wallach, *Otto*, and *Franz* **Neumann**, compounds of the carvacrol and thymol series, i, 546.
Waller, *Elwyn*, and *A. J.* **Moses**, nickel arsenide, ii, 21.
Walter, *Georg*, polymeric ethoxysulphonethylenesulphinic lactone, i, 85.
—— some derivatives of ethoxymethylsulphone, i, 85.
Walter, *H.* See *F.* **Krüger.**

Walter, *Johann*, oxidation by incomplete combustion, i, 271.

Walter, *L. Edna*, note on thio-derivatives from sulphanilic acid. PROC., **1895**, 141.

Walther, *R.*, constitution of diazo-compounds, i, 515.

—— reduction by means of phenylhydrazine, i, 595.

Wanklyn, *J. Alfred*, and *William J.* **Cooper**, new class of compounds of the inactive hydrocarbons, i, 77, 437.

Warburg, *Emil*, electrical conductivity and convection in dilute solutions of small conductivity, ii, 252.

—— action of the silent discharge on lead oxide, ii, 267.

Ward, *Henry A.*, Plymouth meteorite, ii, 320.

Warren, *Henry N.*, magnesium voltaic cell, ii, 35.

—— analysis of zinc and copper alloys, ii, 186.

—— nitrocellulose filters, ii, 325.

—— detection and estimation of selenium in meteoric iron, ii, 369.

—— separation of gold and silver from iron and steel, ii, 536.

Warren, *R.* See *M. S.* **Pembrey.**

Watson, *W.* See *J. W.* **Rodger.**

Weber, *Carl O.*, analysis of rubber goods, ii, 191.

Weber, *H. A.*, and *William* **McPherson**, estimation of cane sugar in the presence of commercial glucose, ii, 296.

—— —— action of acetic and hydrochloric acids on cane sugar, ii, 297.

Wedekind, *Edgar.* See *H. v.* **Pechmann.**

Weems, *J. B.*, electrosyntheses by the direct union of feeble organic acids, i, 208.

Wegscheider, *Rudolf*, hemipinic acid and its ethereal salts, i, 420.

—— formation of ethereal salts, i, 499.

—— affinity constants of dibasic acids and of acid ethereal salts, ii, 310.

Wehmer, *Carl*, calcium citrate in plants, ii, 27.

Weibull, *Mats*, analysis of milk, ii, 145.

—— analysis of sour milk, ii, 247.

—— composition of idocrase, ii, 511.

Weil, *Hugo*, tetramethyldiamidobenzhydrol, i, 145.

—— condensations with formaldehyde, i, 148.

—— constitution of the triphenylmethane colour bases, i, 234.

Weil, *Hugo.* See also *E.* **Thiele.**

Weil, *Sylvian.* See *R.* **Fittig.**

Weiler, *Max.* See *P.* **Jannasch.**

Weingarten, *P.* See *P.* **Jannasch.**

Weinig, *M.*, α-bromopropionic acid, i, 16.

—— dimethylacrylic acid, i, 17.

Weinland, *G.*, chemical stimulation of ciliated epithelium, ii, 80.

Weintraud, *W.*, excretion of acetone, diacetic acid, and β-hydroxybutyric acid in diabetes, ii, 281.

Weisberg, *Julius*, amount of magnesia and lime in sugar juice, i, 79.

—— occurrence of oxalic acid in beet roots, ii, 177.

Weisberg, *J.* See **Friedlaender.**

Weiske, *Hugo*, action of calcium and other salts on the animal organism, ii, 53.

—— amount and composition of the contents of the stomach and intestine of rabbits at different periods of feeding, ii, 120.

—— addition of calcium phosphate to food, ii, 121.

—— digestibility of pentosans, ii, 278.

—— acid fodder and its effects on the organism, ii, 517.

—— composition of the bones, teeth, &c., of wild and tame rabbits, ii, 519.

Weiske, *Hugo.* See also *A.* **Wicke.**

Weiss, *Franz*, ethereal salts of anhydro-α-amido acids: synthesis of mercapturic acids, i, 284.

Weisse, *Karl*, triphenylthienylmethane, i, 543.

Welander, *E.*, undecanonic acid, i, 447.

Welbel, *B.*, and *Simon* **Zeisel**, estimation of furfuraldehyde in pentoses and pentosans, ii, 426.

Wells, *Horace L.*, iodine compounds of lead with excess of iodine, ii, 449.

Welt, *Ida*, active amylacetic acid and its derivatives, i, 203.

—— saturated hydrocarbons containing the active amyl radicle, ii, 97.

Wendelstadt, *H.*, and *L.* **Bleibtreu**, human blood in disease, ii, 123.

Wendt, *Gustav*, preparation of condensation products from chloroform and benzene, i, 278.

Wenghöffer, *Ludwig*, paraphenetoïlcarbamide "dulcin," i, 359.

—— purification of guaiacol by strong cooling, i, 412.

Wense, *Wilhelm*, estimation of bromine in presence of chlorine, ii, 289.

Wenzel, *Franz*, synthesis of kynurine, i, 70.

Werenskiold, *F. H.*, and *E.* **Solberg**, analyses of Norwegian hay grasses, ii, 324.

Werner, *Alfred*, chlorides of hydroximic acids and their products of change, i, 88.

—— constitution of inorganic compounds, ii, 225, 499.

Werner, *Alfred*, and *F.* **Bial**, hydroxylamineisobutyric acid, i, 521.

Werner, *Alfred*, and *Hans* **Buss**, nitrolic acids, i, 456.

—— —— benzyl ethers of oximes, i, 461.

Werner, *Alfred*, and *A.* **Klein**, salts of amidochromic acid, ii, 450.

Werner, *Alfred*, and *E.* **Sonnenfeld**, hydroxylamineacetic and α-hydroxylaminepropionic acids, i, 125.

Werner, *G.*, derivatives of metahydroxybenzaldehyde, i, 663.

Wesbrook, *F. F.*, effect of sunlight on tetanus cultures, ii, 58.

Wesendonck, *K.*, the critical state, ii, 71.

Wheeler, *Henry L.*, action of benzimidoethyl ether on aromatic orthocompounds, i, 522.

Wheeler, *L. H.* See *J.* **Thiele.**

Whetham, *W. C. Dampier*, velocities of the ions, ii, 477.

White, *W. Hale*, use of levulose in diabetes, ii, 520.

White, *W. Hale.* See also *M. S.* **Pembrey.**

Whitehead, *Cabell*, estimation of tellurium in copper bullion, ii, 289.

Whiteley, *Miss M. A.* See *H.* **Crompton.**

Whitney, *W. R.* See *A. A.* **Noyes.**

Whitridge, *Andrew H.* See *T. W.* **Richards.**

Wicke, *A.*, and *Hugo* **Weiske**, influence of fat and acid on metabolism, ii, 516.

Widman, *Oscar*, α-acetylphenylhydrazine, i, 31.

—— phenylazocarboxylic acid and tribromophenylazocarboxylic acid, i, 603.

Wiechmann, *F. G.*, basswood oil, ii, 285.

Wiede, *O. F.* See *K. A.* **Hofmann.**

Wiedemann, *Eilhard*, and *G. C.* **Schmidt**, formation of ozone by the action of electric oscillations, ii, 109.

Wiegand, *P.* See *T.* **Zincke.**

Wiener, *E.* See *F.* **Kratschmer.**

Wigner, *J. H.* See *P.* **Jannasch.**

Wiik, *Frederik J.*, crystallochemical theory of the silicates, ii, 22.

Wildermann, *Mejer*, experimental proof of the laws of Van't Hoff, Arrhenius, and Ostwald for dilute solutions, ii, 105.

Wilderman, *Mejer*, determination of the freezing point of water, ii, 105.

Wilkinson, *L. W.*, iodonium bases derived from parachloriodobenzene, i, 221.

Will, *Wilhelm*, nitronaphthalenes, i, 235.

—— naphthazarin from 1 : 2 : 1′ : 4′-tetranitronaphthalene, i, 668.

Willgerodt, *Conrad*, removal of phosphine from acetylene prepared from calcium carbide; compound of silver aectylide with silver nitrate: preparation of iodinium compounds, i, 635.

Williamson, *Sidney.* See *T.* **Purdie.**

Willstätter, *Richard*, formation of carbon rings. Conversion of pimelic acid into cyclopentenedicarboxylic acid, i, 338.

Willstätter, *Richard.* See also *A.* **Einhorn.**

Windisch, *W.*, volumetric estimation of sulphuric acid, ii, 137.

Winkler, *Clemens*, atomic weight of nickel and cobalt, ii, 167, 318.

Winogradsky, *Sergei*, assimilation of free atmospheric nitrogen by microbes, ii, 283.

Winter, *J.*, analysis of gastric juice, ii, 543.

Winterstein, *Ernst*, nitrogenous compound from fungus-cellulose, i, 80, 124.

—— fungus cellulose, i, 124.

—— products of the hydrolysis of fungus cellulose, i, 199.

—— two carbohydrates from fungi, i, 323.

—— glucosamine, i, 493.

Winterstein, *Ernst.* See also *E.* **Schulze.**

Wirkner, *C. G. v.* See *G. W. A.* **Kahlbaum.**

Wirsing, *F.* See *T.* **Curtius.**

Wirth, *Ernst.* See *A.* **Baeyer.**

Wislicenus, *Hans*, and *Ludwig* **Kaufmann**, amalgamated aluminium as a neutral reducing reagent, i, 437.

—— —— reactions of aluminium amalgam, i, 634.

Wislicenus, *Wilhelm*, ethylic formylsuccinate, i, 127.

—— elimination of carbonic oxide, i, 329.

—— isomerism of ethylic formylphenylacetate, i, 366.

Wislicenus, *Wilhelm*, and *Walter* **Beckh**, action of ammonia on ethylic oxalacetate, i, 335.

Wislicenus, *Wilhelm*, and *August* **Boeckler**, ethylic dioxalosuccinate, i, 506.

Wislicenus, *Wilhelm*, and *Karl* **Goldstein**, syntheses by means of ethylic phenylmalonate, i, 368.

Wislicenus, *Wilhelm*, and *Max* **Nassauer**, ethylic oxalosuccinate, i, 506.

Witter, *Hugo*. See *E.* **Buchner.**

Wolf, *F.* See *A.* **Claus.**

Wolff, *C.* See *W.* **Krüger.**

Wolff, *F. A.*, jun., influence of magnetism on chemical action, ii, 153.

Wolff, *Heinrich*, *d*-glucosebenzoylhydrazide, i, 216.

Wolff, *Ludwig*, derivatives of furazan, i, 192.

Wolffenstein, *Richard*, concentration and distillation of hydrogen peroxide, ii, 73.

—— conium alkaloïds, i, 253.

—— action of hydrogen peroxide on coniine and β-pipecoline, i, 479.

—— action of hydrogen peroxide on acetone and mesityl oxide, i, 644.

Wolffenstein, *Richard*. See also *L.* **Levy.**

Wolpert, *H.*, percussive ebullition, ii, 340.

—— improvements in glass stopcocks, ii, 345.

Wrampelmeyer, *E.*, estimation of the value of phosphates insoluble in water, ii, 139.

Wright, *Almroth E.*, influence of carbonic anhydride and oxygen on blood coagulation, ii, 78.

Wright, *Charles R. A.*, obituary notice of, Trans., 1113.

Wright, *Lewis T.*, a property of the non-luminous coal gas flame, Proc., **1895**, 72.

Wróblewski, *Augustin*, caseïn of human milk, ii, 54.

—— action of thiocyanic acid on gastric ferments, ii, 403.

—— pepsin, ii, 516.

Woy. See **Seyda.**

Wulff, **C.** See *M.* **Krüger.**

Wunsch, *A.*, benzoylquinine, i, 118.

Wynne, *William P.*, and *James* **Bruce**, the disulphonic acids of toluene and of ortho- and para-chlorotoluene, Proc., **1895**, 152.

Wynne, *William P.*, and *Alfred* **Greeves**, the six dichlorotoluenes and their sulphonic acids, Proc., **1895**, 151.

Wynne, *William P.* See also *H. E.* **Armstrong.**

Wypfel, effect of chlorides on the growth of plants, ii, 175.

Wyrouboff, *Grégoire*, amidochromates, ii, 272.

Y.

Yabe, *K.*, poisonous action of the hydroxy-derivatives of benzene on yeast and bacteria, ii, 130.

—— the vegetable cheese, Natto, ii, 130.

Young, *George*, synthesis of diphenyloxytriazole, Trans., 1063.

—— action of benzaldehyde on phenylsemicarbazide, Proc., **1895**, 124.

—— action of hydrogen on amorphous phosphorus, ii, 348.

Young, *Sydney*, influence of the relative volumes of liquid and vapour on the vapour pressure of a liquid at constant temperature, ii, 203.

Young, *Sydney*, and *G. L.* **Thomas**, dephlegmator for fractional distillation, ii, 304.

Young, *Sydney*. See also *G. L.* **Thomas.**

Z.

Zacharewicz, *Ed.*, manuring natural meadows, ii, 458.

Zaharia, *A.* See *L.* **Edeleanu.**

Zanetti, *Carlo U.*, compound of pyrroline with hydroferrocyanic acid, i, 390.

Zanetti, *Carlo U.*, and *E.* **Levi**, tetrahydrocarbazole, i, 54.

—— —— synthesis of pyrroline compounds from nitrosoketones, i, 68.

Zay, *C. E.*, estimation of organic nitrogen by Stocks' method, ii, 86.

Zega, *Alexander*, action of organic matters on potassium permanganate, ii, 90.

—— estimation of fatty acids of butter soluble in water containing sulphuric acid, ii, 539.

Zehenter, *Josef*, centrifugal fat estimation in milk, ii, 539.

Zeisel, *Simon*. See *B.* **Welbel.**

Zeiser, *F.*, tolyl-derivatives of sulphur selenium and tellurium, i, 512.

Zelinsky, *Nicolai D.*, sodium and potassium nitromethane, i, 123.

—— synthesis of naphthenes, i, 339.

—— hexamethylene, i, 411.

Zelinsky, *Nicolai D.*, and *A.* **Doroschewsky**, ethylic allylenetetracarboxylate, i, 129.

Zelinsky, *Nicolai D.*, and *W.* **Rudewitsch**, 1 : 3-diethylhexamethylene, i, 454.

Zenetti, *P.*, occurrence of hesperidin in *Folia bucco*, ii, 408.

Zengelis, *C.*, tetrahydronaphthalic acid, i, 57.
Zepernick, *K.*, and *Gustav* **Tammann**, volumes of aqueous salt solution between 100° and 150°, ii, 307.
Zeynek, *Richard v.*, the contents of two lymph cysts, ii, 280.
Zielstorff, *W.* See *A.* **Köhler.**
Zikes, *Heinrich.* See *R.* **Benedikt.**
Zincke, *Theodor*, azo-derivatives of phenyl-β-naphthylamine, i, 238.
—— action of chlorine on catechol and amidophenol, i, 131.
—— an acid, $C_5H_6O_2$, from hexachloroketopentene, i, 510.
Zincke, *Theodor*, and *M.* **Engelhardt**, dichloroxindenecarboxylic acid, i, 231.
Zincke, *Theodor*, and *Max* **Schmidt**, halogen-additive compounds from α- and β-naphthaquinone, i, 56.
—— —— naphthazarin, i, 613.
Zincke, *Theodor*, and *P.* **Wiegand**, αα-diketotetrahydronaphthalene oxide, i, 615.
Zopf, *Wilhelm*, compounds from lichens, i, 297.
Zoppellari, *I.*, atomic refraction of selenium, ii, 249.
Zorn. *L.*, and *H.* **Brunel**, constitution of aromatic sulphones, i, 287.
Zulkowski, *Karl*, corallin and rosaniline, i, 667.
Zulkowski, *Karl*, and *Enrico* **Poda**, new process for drying hygroscopic substances, ii, 325.
Zuntz, *N.* See *A.* **Loewy.**

INDEX OF SUBJECTS.

ABSTRACTS. 1895. Parts I & II.

And also to Transactions, 1895 (marked Trans.); and to such papers as appeared in the Proceedings during the Session 1894—1895 (Nos. 142 to 154; Nov., 1894, to July, 1895), but not in Transactions (marked Proc.).

A.

Abietic acid, i, 384.
Acacia decurrens, carbohydrates of the gum of, ii, 285.
Acetal, amido-, phthalyl, compounds of, i, 90.
Acetaldehyde, action of nitromethane on, i, 638.
—— amido-derivatives of, i, 89.
—— chlor-, heat of formation of the crystalline polymeride of, ii, 307.
—— chlor-, dichlor-, and trichlor-, heat of formation of, ii, 306.
—— dibrom-, hydrate of, i, 317.
—— rate of oxidation of, ii, 213.
Acetaldehydehydroxyfluorone, i, 47.
Acetaldehydetetramethylamidofluorimium hydrochloride, i, 47.
Acetamide, action of nitrosyl chloride on, Trans., 489.
—— electrolysis of, i, 209.
—— heat of formation of, ii, 483.
—— preparation of the sodium derivative of, i, 289.
Acetanilide, action of, on mercuric acetate, i, 357.
Acetanilide and *m*-dinitrobenzene, melting points of mixtures of, Trans., 331.
—— and *a*-dinitrophenol, melting points of mixtures of, Trans., 331.
—— and *m*-nitraniline, melting points of mixtures of, Trans., 330.
—— chlor-, action of phenylhydrazine on, i, 521.
—— heat of formation of, ii, 483.
Acethydrazide, i, 263.
Acetic acid, affinity constant of, ii, 253.
—— —— and its chloro- and bromo-derivatives, comparison of the properties of, Trans., 664.
Acetic acid and its halogen derivatives, rate of etherification of, ii, 159.
—— —— chlor-, isomeric modifications of, Trans., 665, 669.
—— —— influence of electrolytes on the conductivity of, ii, 68.
—— —— molecular complexity of, ii, 41.
—— —— thio-, as a substitute for hydrogen sulphide in qualitative analysis, ii, 84.
Acetic anhydride, chlor-, i, 17.
Acetic chloride, chlor- and trichlor-, heat of formation of, ii, 254.
Acetins, amorphous and crystalline forms of, i, 409.
Acetoacetic acid, excretion of, in diabetes, ii, 281.
Acetobenzoic anhydride, i, 593.
Acetol ethylic ether and its derivatives, i, 5.
Acetone, action of boron fluoride on, i, 453.
—— action of ethylic chlorocarbonate on the sodium derivative of, i, 201.
—— action of hydrogen peroxide on, i, 644.
—— action of nitric acid on, i, 201.
—— amido-, action of nitrous acid on, i, 328.
—— condensation of, with ethylic malonate, i, 410.
—— condensation of, with methylethylacraldehyde, i, 644.
—— condensation of, with propaldehyde, i, 643.
—— condensation of, with *iso*-valeraldehyde, i, 645.

Acetone, contraction in the formation of aqueous solutions of, i, 15.
—— detection of, in urine, ii, 537.
—— diamido-, preparation of, i, 496.
—— estimation of, in urine, ii, 407.
—— excretion of, in diabetes, ii, 281.
—— peroxide, trimolecular, i, 644.
—— unsymmetrical tetrachlor-, i, 259.
Acetonebenzoylhydrazines, *o*-, *m*-, and *p*-, i, 276.
Acetonebenzoylhydrazone, i, 35.
Acetone-2 : 4-dinitrophenylhydrazone, i, 29.
Acetoneglycerol, i, 441.
Acetonehydrazonediphenyl, i, 97.
Acetonepicrylhydrazone, i, 30.
Acetone-rhamnoside, i, 440.
Acetones, amido-, disubstituted, i, 681.
Acetonitrile, compounds of aluminium chloride with, i, 636.
—— physiological action of, ii, 238.
Acetonuria, ii, 407.
Acetophenone, action of ammonium sulphide on, i, 363.
—— *p*-amido-, i, 177.
—— thio-, i, 362.
Acetophenonebenzoylhydrazine, i, 35.
Acetophenoneglycolylhydrazine, i, 332.
Acetophenonehydrazonediphenyl, i, 97.
Acetophenonesuccinylhydrazine, i, 264.
Acetopropionyldinitrile, i, 584.
Acetothienone, bromo-, i, 509.
Acetovaleric anhydride, i, 592.
Acetoxime, action of nitric peroxide on, i, 446.
—— benzyl ether of, i, 461.
—— nitro-, i, 685.
Acetoxymethylenecamphor, i, 64.
Acetoxymethylenementhone, i, 65.
Acetoxymethylenepropyl phenyl ketone, i, 65.
Acetoxyphenylcoumalin, i, 110.
Acetylacetone, i, 501.
—— action of sulphur chloride on the copper derivative of, i, 168.
—— oxidation and electrolysis of, i, 208.
Acetylalantolamide, i, 555.
m-Acetylamidoazobenzene, TRANS., 926.
o-Acetylamidobenzylic bisulphide, i, 432.
—— sulphide, i, 191.
Acetylamidocarvacrol, i, 546.
—— methyl ether, i, 546.
Acetyl-*α*-amidocinnamic acid, i, 281.
2 : 1 : 4-Acetylamidodimethylnaphthalene, i, 424.
Acetylamidodiphenylenepyrodiazoline, i, 213.
Acetylamidohydroxymethyl-*m*-diazine, i, 266.
Acetylamidohydroxyphenyl-*m*-diazine, i, 266.
Acetylamidomaleïmide, i, 356.
Acetylamidonaphthaphenazine, i, 151.
4-Acetamido-1 : 2-naphthaquinol, i, 151.
2-Acetylamido-1 : 4-naphthaquinol, i, 151.
4-Acetylamido-1 : 2-naphthaquinone, i, 151.
—— condensation of, with phenyl-*o*-phenylenediamine, i, 148.
2-Acetylamido-1 : 4-naphthaquinone, i, 151.
4-Acetylamido-1 : 2-naphthaquinoxime, i, 151.
2-Acetylamido-1 : 4-naphthaquinoxime, i, 151.
4-Acetylamido-1-naphthonitrile, i, 670.
Acetyl-*p*-amidophenyl-*α*-naphthylamine, i, 601.
2′-Acetylamidoquinoline methiodide, i, 156.
Acetylamidothymol, i, 547.
—— methyl ether, 547.
Acetylamidoveratric acid, i, 367.
Acetylamidrazonehydrazone, isomeride of, i, 573.
Acetyl-*β*-anhydrodigitic acid, i, 66.
Acetylanilidocollidine, i, 562.
Acetylaniline, di-*o*-brom, i, 594.
Acetyl-*m*-azo-*o*-toluidide, i, 520.
Acetylbenzamide, nitro-, i, 266.
Acetylbenzeneazo-*β*-naphthaquinol, i, 617.
Acetylbenzene-*p*-azonaphthylamine, i, 669.
Acetylbenzoïnhydrazine, i, 607.
Acetylbenzoylhydrazine, i, 34.
Acetylbenzoylmethane, electrolysis of, i, 209.
“Acetyl-*p*-benzylenimide,” i, 523.
Acetyl-*α*-benzylideneamidophenyllactic acid, i, 281.
Acetyl-1-benzyl-2-tolylnaphthylenediamine, i, 59.
Acetyl-*p*-*iso*-butylsalicylonitrile, i, 222.
Acetylcarbamide, metallic derivatives of, i, 269.
Acetylcarbinylic ethylic ether and its derivatives, i, 5.
Acetylcarvacrol, bromo-, i, 547.
Acetylcinchotinine, i, 403.
Acetyl-*anti*-cinnamaldoxime, i, 139.
Acetylcinnamylideneacetoxime, i, 562.
Acetyldecarbusneïn, i, 299.
Acetyldiamido-*m*-toluoyl-*o*-uramide, i, 524.
Acetyldifurfuryltriazole, i, 271.
Acetyldihydrophenonaphthacridine, i, 107.
Acetyl-3 : 2′-dihydroxybenzophenone, i, 233.
Acetyl-*αβ*-dihydroxynaphthaphenazine, i, 616.

Acetyldimethylbutyric acid, i, 677.
Acetyldimethyldiphenyldisulphone-*p*-phenylenediamine, i, 144.
Acetyldimethylethoxyamidodiphenylamine, i, 27.
Acetyl-1 : 4-dimethylnaphthylamine, i, 424.
Acetyldimethylthiophen, bromo-, i, 509.
Acetyl-2 : 4-dinitrophenylhydrazine, i, 27, 29.
Acetyldiphenylketipamidonitrile, i, 101.
Acetyl-1 : 5-diphenyl-3-oxytriazole, Trans., 1066.
Acetyldiphenylthiocarbamide, i, 461.
Acetyldiresorcinolacetic acid, i, 367.
Acetyldithiourazole, i, 401.
Acetyldi-*p*-tolyltriazole, i, 138.
Acetylene, compound of, with mercuric chloride and oxide, i, 5.
—— explosion of, with oxygen, i, 2.
—— flame of, Trans., 1059.
—— hydrate, i, 636.
—— hydration of, i, 197.
—— incomplete combustion of, Proc., **1894**, 180.
—— occurrence of, in flames, Trans., 1057.
—— physical properties of, i, 635.
—— prepared from calcium carbide, removal of phosphine from, i, 635.
—— theory of luminous hydrocarbon flames, Trans., 1049.
Acetylene-hydrocarbons, disubstituted, action of hypochlorous acid on, i, 496.
2 : 1-Acetylethoxynaphthalene, i, 668.
—— phenylhydrazone of, i, 668.
α-Acetyl-β-ethoxypropylene, i, 501.
Acetylethyleuxanthone, dibromo-, i, 554.
Acetylethyl-*o*-toluidine, *p*-nitro-, Trans., 247.
Acetylfluoresceïn ethylic ether, i, 183.
Acetyl-*p*-hydrazidodiphenyl, i, 97.
Acetylhydrogalalic acid, i, 180.
3 : 1 : 6-Acetylhydroxymethylhexamethylene, i, 674.
δ-Acetyl-β-hydroxy-*iso*-propylvaleric acid, lactone of, i, 508.
Acetylisatic acid, nitro-, i, 288.
Acetyl-ψ-isatin, nitro-, i, 288.
Acetylisatinphenylhydrazone, i, 288.
—— brom-, i, 288.
Acetylisatin-*o*-tolylhydrazone, i, 288.
Acetylketohydroxystearic acid, i, 82.
Acetyllaudanidine, i, 117.
Acetylluteol, i, 573.
Acetylmalic acid, rotatory powers of ethereal salts of, ii, 251.
Acetylmaltose, rotatory power of, i, 260.
Acetylmetanicotine, i, 116.
2 : 1-Acetylmethoxynaphthalene, i, 668.
Acetylmethyldibenzylketone, i, 375.
Acetyl-*p*-methylisatic acid, i, 398.
Acetylmethylnitrolic acid, i, 201.
1 : 3-Acetylmethylpyrazolone, i, 246.
Acetylmethylthiophen, bromo-, i, 509.
Acetylnaphthalphenylhydrazone, i, 240.
α-Acetylnaphthalide, dichlor-, i, 106.
—— 4 : 2-iodonitro, Trans., 912.
Acetylnaphthaquinone chlorimide, i, 668.
Acetylnaphthazarin, tetrachloro-, i, 614.
2 : 1-Acetylnaphthol, 4-amido-, i, 668.
—— 4-nitro-, i, 668.
—— —— phenylhydrazone of, i, 668.
2 : 1-Acetylnaphthol-4-sulphonic acid, i, 668.
Acetylnaphthoresorufin, i, 246.
Acetyloxalyldibenzyl ketone, i, 374.
Acetyl-*iso*-oxalyldibenzyl ketone, i, 375.
1-Acetylphenopyridazolone, i, 303.
Acetylphenyl-μ-amidophenylinduline, i, 608.
Acetylphenyldithiourazole, i, 402.
Acetyl-*cyclo*-phenylenebenzylidene oxide, i, 537.
Acetylphenylglycoline, i, 155.
—— ethyl ether, i, 155.
Acetylphenylhydrazine, action of magnesium on, Proc., **1895**, 10.
α-Acetylphenylhydrazine, i, 31.
β-Acetylphenylhydrazine, tribromo-, i, 604.
Acetylphenyl-α-naphthylamine, *p*-nitroso-, i, 601.
1-Acetyl-3-phenylphenopyridazolone, i, 303.
Acetylphenylpyrazolinedicarboxylic acid, i, 250.
1 : 3-Acetylphenylpyrazolone, i, 687.
4 : 3-Acetylphenylpyrazolone, i, 247.
1 : 3-Acetylphenylpyrazolone-4-azobenzene, i, 687.
Acetyl-4′-phenyltetrahydroquinoline, i, 431.
Acetylpicrylhydrazine, i, 28, 30.
Acetylpiperylcarbamide, i, 36.
Acetylpropionitrile, imido-, i, 584.
1-Acetylpyrazole, i, 397.
Acetylsarcosine, i, 176.
Acetylscopoleïne, i, 632.
Acetylsordidin, i, 388.
Acetylsuccinoresinol, i, 385.
Acetyltetrethylquercetin, dibromo-, i, 554.
Acetylthebaol, i, 402.
Acetylthebaolquinone, i, 402.
Acetylthymoquinoneoxime, i, 529.
Acetyl-*m*-toluidine, 2-chloro-, Proc., **1895**, 152.
—— 5 : 6-dichloro-, Proc., **1895**, 152.
Acetyl-*o*-toluidine, chloro-, Proc., **1895**, 152.

Acetyl-*p*-toluidine, 2-chloro-, Proc., **1895**, 152.
Acetyltoluquinol, nitro-, i, 513.
Acetyltoluresinotannol, i, 189.
Acetyltrimethylcyanopropionic acid, Trans., 426.
Acetyltrimethyldihydroquinoline, i, 69.
Acetyltrimethyl-*m*-phenylenediamine, i, 599.
1-Acetyl-3 : 4 : 4-trimethylpyrazolone, i, 687.
Acetyl-*iso*-undecylamine, i, 324.
Acetylveratrylpseudaconine, Proc., **1895**, 155.
Achroocellulose, i, 166.
Achroodextrin I, i, 492.
Achroodextrin II, i, 492.
Achroodextrin, a second, formed by the action of diastase on starch, i, 409.
Acid, $C_5H_6O_2$, from hexachloroketopentene, i, 510.
—— $C_{11}H_{16}O_2$, from fenchocarboxylic acid, i, 381.
—— $C_{10}H_{16}O_3$, from the oxidation of fenchone, i, 381.
—— $C_7H_{12}O_4$, from rhodinol, i, 78.
—— $C_8H_{14}O_4$, from the oxidation of camphoric acid, i, 552, 679.
—— $C_{10}H_{18}O_4$, from hydroxypentadecoic acid, i, 120.
—— $C_8H_{12}O_4$, from the oxidation of camphoric acid, i, 552, 679.
—— $C_{10}H_{14}O_4$, derived from π-bromocamphoric acid, Proc., **1895**, 88.
—— $C_8H_{12}O_5$, from the oxidation of camphoric acid, i, 552, 679.
—— $C_{10}H_{12}O_5$, derived from π bromocamphoric acid, Proc., **1895**, 88.
—— $C_{17}H_{16}O_5$, dibasic, from *iso*-oxalyldibenzyl ketone, i, 376.
—— $C_{10}H_{14}O_6$, derived from π-bromocamphoric acid, Proc., **1895**, 88.
—— $C_{14}H_{16}O_6$, obtained by oxidation of filicic acid, i, 68.
—— $C_{26}H_{28}O_{16}$, from sordidin, i, 388.
—— $H_2S_2O_2$, salts of the, i, 258.
—— of m. p. 180° from amidolauronic acid, i, 296.
Acid solutions, standardising, ii, 368.
Acid-amides, aromatic, hydrolysis of, Trans., 601.
Acid-hydrazides, i, 32.
—— action of nitrous acid on, i, 33.
Acidimetry, precautions in, ii, 134.
Acid-imides, behaviour of, in the animal organism, ii, 280.
Acids, $C_{17}H_{31}·COOH$, from ricinoleïc acids, i, 126.
Acids, action of, on the gastric secretion, ii, 77.
—— alcohols and aldehydes, thermochemical relations between, ii, 435.
Acids, amido-, ethereal salts of, i, 602.
—— aromatic, etherification of, i, 93, 228, 466.
—— —— orthosubstituted, diagnosis of, by means of the iodoso-reaction, i, 178.
—— —— the law of etherification of, i, 93.
—— —— unsaturated, synthesis of, i, 542.
—— determination of the affinities of, colorimetrically, ii, 386.
—— dibasic, affinity constants of, ii, 310.
—— dissolved, molecular refraction of, Trans., 831.
—— fatty, decomposition of, by oxidation at ordinary temperatures in the absence of ferments, i, 125.
—— —— *iso*-nitramine and oxazo-derivatives of, i, 502.
—— —— phenyl-substituted, antiseptic action of, ii, 58.
—— —— relation between the constitution of, and the solubility of their salts, ii, 7.
—— —— saturated, affinity constants of, ii, 253.
—— —— soluble in water containing sulphuric acid, estimation of, in butter, ii, 539.
—— —— volatile, periodic estimation of, in the butter produced during a year, ii, 95.
—— hydroxy-, action of acidic oxides on the salts of, Trans., 102, 1030.
—— inorganic, complex, ii, 18, 112, 229, 274.
—— imidic, i, 648.
—— organic, azides and hydrazides of, i, 32.
—— —— electro-syntheses by the direct union of anions of feeble, i, 208.
—— —— formation and decomposition of, in higher plants, ii, 127.
—— —— reduction of the chlorides of, Proc., **1894**, 216.
—— oxy-, constitution of, ii, 499.
—— trihydroxy, from ricinoleïc acid, i, 126.
—— unsaturated, i, 16.
—— —— dicarboxylic, synthesis of, from ethylic succinate and ketones, i, 142.
—— —— intramolecular changes in, i, 204, 533.
—— use of zone reactions in testing for, ii, 135.
—— volatile, estimation of, in wines, ii, 538.
Acidyltartrates, aromatic, i, 267.
Acidylthiocarbimides, Trans., 1040.

Aconic acid, i, 128.

Aconite alkaloïds, Trans., 459; Proc., **1895**, 154

Aconitic acid, configuration of, i, 157.

Aconitine, acetyl derivatives of, Trans., 459.

—— aurochlorides, Proc., **1895**, 27.

—— constitution of, Trans., 459, 464; i, 254, 631.

—— history of, i, 254.

Aconitoxalic acid, ammonium triethylic salt of, i, 335.

Acridine, formation of, from *n*-nitrodiphenylmethane, i, 476.

Acridone, synthesis of, i, 147.

Actinolite from Ouro Preto, Brazil, ii, 116.

Adelite, ii, 22.

Adenine, separation of hypoxanthine and uric acid from, ii, 94.

Adipic acid, preparation of, Trans., 155.

—— —— bromo-, Trans., 159.

Adsorption in dilute solutions, ii, 39.

Ægirine from Greenland, ii, 23.

Affinities of feeble bases, Trans., 576.

—— relative, of organic bases in alcoholic solution, ii, 259.

Affinity constants, calculation of, ii, 490.

—— —— of dibasic acids, ii, 310.

—— —— of the saturated fatty acids, ii, 253.

—— —— of ureides and isonitroso-derivatives, ii, 308, 310.

Agave Americana, the sugar of the, ii, 363.

Agavose, real nature of, ii, 363.

Air, bactericidal action of, ii, 57.

—— estimation of carbonic anhydride in, ii, 32.

—— liquid, absorption spectrum of, ii, 471.

—— —— phosphorescence and photographic action at the temperature of boiling, Proc., **1894**, 171.

—— —— spectrum of the electric discharge in, ii, 34.

Air-bath made of aluminium, ii, 9.

Alantolactone (helenin), i, 555.

—— hydrocarbons from, i, 556.

—— salts of, i, 555.

Alantolamide, i, 555.

Alantolic acid, i, 555.

Albumin, ash free, i, 196.

—— colour reaction for, ii, 376.

—— detection and estimation of, in urine, ii, 543.

—— estimation, densimetric, of, ii, 300.

—— estimation of, in presence of peptone, ii, 375.

Albumin, estimation of, in urine, ii, 190, 543.

—— iron compounds of, i, 196.

—— pancreatic digestive products of, ii, 233.

—— relation of fat and carbohydrates to the decomposition of, in the human body, ii, 404.

—— serum-, crystallisation of, i, 255.

—— state of combination of sulphur in, i, 255, 691.

Albuminous liquids, determination of the osmotic pressure of, by the cryoscopic method, ii, 7.

Albumins, colour reactions for, ii, 36, 376.

—— sulphur derivatives of, i, 691.

Albuminuria, ii, 82.

Albumoses in serous effusions, ii, 81.

Alburnus lucidus, silvery substance in the skin of, ii, 279.

Alcaptonuria, ii, 83.

Alcohol from essence of cananga, i, 426, 552.

—— methylated, purification of, with carbon tetrachloride, i, 488.

—— secondary, from pinole tribromide, i, 60.

Alcohols, action of magnesium on the vapours of, i, 405.

—— aldehydes, and acids, thermochemical relations between, ii, 435.

—— compounds of sugars with, i, 437.

—— fatty, condensation of formaldehyde with, i, 14.

—— —— saturated, and Trouton's law, ii, 101.

—— —— —— heat of vaporisation of, ii, 101.

—— nitro-, i, 637.

—— oxidation of, by Fehling's solution, i, 197.

—— polyhydric, combination of, with ketones, i, 441.

—— purification of, i, 260.

—— reducing action of, at high temperatures, i, 538.

—— secondary action of chlorine on, i, 259.

Aldehyde. See Acetaldehyde.

Aldehyde from rhodinol, i, 78.

Aldehydecollidine, substituted amido-derivatives of, i, 562.

Aldehydes, action of nitromethane on, i, 637.

—— alcohols, and acids, thermochemical relations between, ii, 435.

—— aliphatic, oxidation of, by nitric acid, i, 201.

—— aromatic, condensation of, with cyanacetamide, malonamide, and malononitrile, i, 651.

Aldehydes, condensation of glutaric acid with, i, 127.
—— condensation of ketones with, i, 643.
—— of the acetic acid series, properties of, i, 446.
—— unsaturated, action of hydrocyanic acid on, i, 16.
Alder, composition of the root nodules of the, ii, 523.
—— influence of the root nodules of the, on the fixation of nitrogen, ii, 522.
Aldoxime salts, i, 657.
Aldoximes, action of thionyl chloride on, ii, 44.
Algæ, fixation of free nitrogen by, ii, 58, 59.
—— sea, colouring matters of, ii, 27.
—— —— formation of substance in, ii, 27.
Alizarin, analysis of cotton dyed with alizarin, i, 108, 671.
—— synthesis of, from hemipinic acid, i, 545.
Alkachlorophyll, i, 296.
Alkali hydroxides and carbonates, estimation of, in presence of alkali cyanides, ii, 185.
—— metals, preparation of, ii, 389.
Alkalimetry, precautions in, ii, 134.
—— sources of error in, ii, 290, 410.
Alkaline solutions, preservation of chemically pure, ii, 108.
Alkalinity of raw sugars, estimation of, ii, 532.
Alkalis, action of, on the gastric secretion, ii, 77.
—— caustic, and carbonates, estimation of, in mixtures, ii, 63, 64.
—— potassium hydrogen tartrate as a material for standardising, ii, 289.
—— titration of, with potassium tetroxalate, ii, 532.
Alkaloïd, new, contained in coffee, i, 629.
Alkaloïds, examination of corpses for, ii, 465.
—— of Cacti, i, 120.
—— of Calabar beans, i, 436.
—— of *Cannabis indica* and *C. sativa*, i. 631.
—— of *Corydalis cava*, Trans., 25.
—— of *Fumariaceæ* and *Papaveraceæ*, i, 689.
—— of *Lupinus albus*, i, 311.
—— of the rind of pomegranate root, i, 160.
—— of *Senecio vulgaris*, i, 632.
Alkylammonium salts, velocity of formation of, ii, 385.
α-Alkylcinchonic acids, i, 71, 72.
Alkyl-groups attached to nitrogen, detection and estimation of, ii, 296.
Alkylic diazo-salts, i, 215.
—— iodides and sulphides, velocity of reactions between, ii, 8.
—— nitrosobutyrates, i, 330.
—— sulphates and sulphonates, separation of, i, 258.
—— —— normal, formation of, by washing tar oils with sulphuric acid, i, 258.
—— sulphonates and sulphates, separation of, i, 258.
Alkylidenemalonic acids and their ethereal salts, action of bromine on, i, 227.
α-Alkylquinolines, i, 71, 72.
Allingite, i, 385.
Alloxan, behaviour of, in the animal organism, ii, 280.
Alloxantin, behaviour of, in the animal organism, ii, 280.
Alloxazine, i, 688.
Alloxuric bases, ii, 94.
Alloys formed at temperatures below the melting points of the component metals, ii, 37.
Allylacetamide, i, 567.
ν-Allyl-αβ-diphenylglyoxaline μ-hydrosulphide, i, 305.
Allylene, hydration of, i, 197.
Allylformamide, i, 567.
Allylic alcohols, secondary, i, 198.
—— iodide, action of hydrazine hydrate on, i, 250.
ab-Allylphenylcarbamide, Trans., 564.
Allylphenylsulphone, i, 229.
ab-Allylphenylurea, Trans., 564.
Allylphosphoric acid, i, 638.
Allyl-*p*-tolylsulphone, i, 229.
ab-Allyl-*o*-tolylthiocarbamide, Trans., 559.
Allyltriacetonamine, i, 328.
Alnus glutinosa, influence of the root nodules of, on the fixation of nitrogen, ii, 522.
Alumina in plants, ii, 284.
—— reduction of, by carbon, ii, 226.
Aluminates, lowering of the freezing point by, ii, 156.
Aluminium, action of, on carbon and its compounds, ii, 167.
—— amalgamated, as a reducing agent, i, 437, 634 : ii, 394.
—— carbide, ii, 167.
—— carbonate, basic, ii, 354.
—— chloride, combination of, with borneol, camphor, and chlorocamphor, i, 61.
—— —— compounds of, with nitro-derivatives of the benzene series, i, 510.
—— —— crystalline, ii, 447.

Aluminium, detection and estimation of, in oils, ii, 463.
—— estimation of, in phosphates, ii, 140, 246, 293, 533.
—— freezing point of, Trans., 187.
—— hydroxides, ii, 354.
—— reduction of, by carbon, ii, 226.
—— separation, qualitative, of chromium from, ii, 88.
—— silicates, action of dilute salt solutions on, ii, 358.
—— sulphate, basic, ii, 353.
—— thiohypophosphate, ii, 13.
—— titration of, with sodium sulphide, ii, 64.
—— use of, in the synthesis of aromatic hydrocarbons, i, 412.
Aluminium-chloride-reaction, nature of, i, 129.
Aluminium-copper alloys, ii, 351, 392.
Aluminosilicates, constitution of, ii, 358.
Amber, i, 384.
Amides, action of nitrosyl chloride on, Trans., 489.
Amidoazobenzeneinduline, i, 608.
Amidochromates, non-existence of, ii, 272.
Amidochromic acid, salts of, ii, 450.
Amidohydroxypicoline, Trans., 223.
Amidoximes, action of halogens and thiocarbonyl dichloride on, i, 661.
Amines, action of formaldehyde on, i, 641.
—— aromatic, preparation of the formyl derivatives of, Trans., 829.
—— fatty, action of inorganic chlorides on, i, 430.
—— —— new series of sulphur derivatives of, i, 200.
—— halogenised, i, 190, 432.
—— primary, interaction of 1 : 2-diketones with, Trans., 32.
—— secondary, new formation of, i, 292.
—— velocity of formation of, ii, 385.
Ammonia, bye-products formed in the action of ozone on, ii, 74.
—— concentrated aqueous, action of hydrogen sulphide on, Trans., 283.
—— estimation of, in tobacco, ii, 541.
—— formed during the combustion of some fuels in air, ii, 62.
—— presence of, in zinc powder, ii, 109.
—— rate of escape of, from solutions of varying concentration, Trans., 871, 878, 879, 984.
—— solution, oxidising action of, on some metals, Proc., **1895**, 9.
—— use of, for standardising acids, ii, 134.
Ammoniocuprammonium acetobromide, i, 329.
—— acetoiodide, i, 330.
Ammoniomercuric cyanide, i, 581.
Ammonio-metallic compounds, constitution of, ii, 225.
Ammonioplatinosopyridine chloride, i, 557.
Ammonioplatosothioethylamine chloride, i, 489.
—— platinochloride, i, 489.
Ammonium amalgam, influence of certain metals on the stability of, ii, 109.
—— amidochromate, non-existence of, ii, 272.
—— antimoniocitrate, Trans., 1031.
—— arseniocitrate, Trans., 1034.
—— arseniotartrate, Trans., 104.
—— arsenites, ii, 218.
—— chloride, action of phosphorus pentachloride on, ii, 217.
—— —— molecular refraction of dissolved, Trans., 836, 844, 865.
—— cobalt dichromate, ii, 355.
—— copper dichromate, ii, 355.
—— cupriferrocyanide, i, 407.
—— cuproferrocyanide, i, 407.
—— cupromanganocyanide, i, 486.
—— cyanate, transformation of, into urea, Trans., 746.
—— dicupric acetate, i, 330.
—— dinitrosoferrothiosulphonate, ii, 318.
—— enneasulphide, Trans., 305.
—— ferric bromide, ii, 165.
—— —— chloride, ii, 165.
—— —— chromate, ii, 227.
—— fluoroxymolybdate, ii, 19.
—— formate, heat of formation of, ii, 483.
—— heptanitrosoferrothiosulphonic acid, ii, 452.
—— heptasulphide, Trans., 306.
—— hydrogen ethoxysuccinates, active, Trans., 966.
—— hydrosulphide, oxidation changes of, Trans., 277.
—— —— preparation of, Trans., 283.
—— —— solid, attempts to prepare, Trans., 286.
—— iodide, molecular refraction of dissolved, Trans., 837, 845.
—— lead iodide, ii, 268.
—— manganese pyrophosphomolybdate, ii, 230.
—— manganic chloride, ii, 46.
—— manganous sulphate, ii, 394.
—— molybdosulphite, ii, 18.
—— orthophosphate, ii, 64, 109.
—— pentasulphide, Trans., 295.
—— phosphoduodecimolybdate, ii, 113.
—— phospholuteomolybdate, ii, 112.
—— platinomolybdates, ii, 230.
—— salts, fused, action of metals on, Proc., **1895**, 114.

Ammonium sodium auropyrophosphomolybdate, ii, 175.
—— —— manganese pyrophosphotungstate, ii, 230.
—— —— tartrates, transition temperature of, ii, 380.
—— —— tungstates, ii, 503.
—— sulphide, attempts to prepare, in solution, Trans., 288.
—— —— crystals, preparation of, Trans., 292.
—— —— solution (reputed), action of sulphur on, Trans., 297.
—— sulphides and polysulphides, Trans., 277.
—— tartrarsenite, Trans., 104.
—— tetrasulphide, Trans., 301, 302.
—— trisulphide, attempts to prepare, Trans., 303.
—— zinc lactates, active, preparation of, Trans., 617.
—— —— sulphate, molecular refraction of dissolved, Trans., 838.
Amorphous condition of fused substances, i, 408.
Amphoterolites, ii, 23.
Amygdalin, i, 553.
—— amorphous, i, 554.
Amylacetic acid, active, and its derivatives, i, 203.
—— —— rotatory power of, ii, 149.
Amylase, i, 692.
iso-Amylcarbamide, Trans., 564.
Amylene, action of boron fluoride on, i, 453.
—— magnetic rotation of, Trans., 256.
Amylic acetate, i, 202.
—— —— rotatory power of, i, 318.
—— alcohol, active, ethereal salts from, i, 202.
—— —— (fermentation), heat of vaporisation of, ii, 101.
—— *iso*-amylic ether, b. p., sp. gr., and rotatory power of, i, 318.
—— benzoate, b. p., sp. gr., and rotatory power of, i, 319.
—— benzylic ether, b. p., sp. gr., and rotatory power of, i, 318.
—— butyrate, i, 202.
—— —— rotatory power of, i, 318.
—— campholate, i, 295.
—— caproate, i, 202.
—— caprylate, i, 202.
—— cetylic ether, b. p., sp. gr., and rotatory power of, i, 318.
—— cyanacetoacetate, i, 649.
—— derivatives, optical activity in the liquid and gaseous states, ii, 473.
—— ether, action of bromine on, in presence of sulphur, i, 317.
—— ethers and ethereal salts, active, i, 317.
Amyllic formate, i, 202.
—— —— rotatory power of, i, 318.
—— heptoate, i, 202.
—— α-hydroxybutyrate, physical properties of, i, 410.
—— lactate, active, and its rotatory power, i, 333.
—— laurate, i, 202.
—— nonylate, i, 202.
Amylic palmitate, i, 202.
—— —— rotatory power of, i, 318.
—— phenylacetate, b. p., sp. gr., and rotatory power of, i, 319.
—— phenylpropionate, b. p., sp. gr., and rotatory power of, i, 319.
—— propionate, i, 202.
—— —— rotatory power of, i, 318.
—— pyruvate, active, and its rotatory power, i, 333.
—— salts, rotatory power of, ii, 149.
—— stearate, i, 202.
—— valerate, i, 202.
—— valerates, rotatory powers of, ii, 196.
—— valerylhydroxybutyrates, rotatory power of, ii, 472.
iso-Amylic α-bromopropionate, i, 16.
sec-Amylic acetate, b. p., sp. gr., and rotatory power of, i, 318.
—— butyrate, b. p., sp. gr., and rotatory power of, i, 318.
—— caproate, b. p., sp. gr., and rotatory power of, i, 318.
—— propionate, b. p., sp. gr., and rotatory power of, i, 318.
—— valerate, b. p., sp. gr., and rotatory power of, i, 318.
iso-Amylideneacetone, i, 645.
iso-Amylideneacetoneamidoguanidine, i. 643.
iso-Amylglutaric acid, brom-, i, 128.
—— —— dibrom-, i, 128.
Amylmalonic acid, rotatory power of, ii, 159.
Amyloïd, i, 255.
iso-Amylphenol, Liebmann's identity of, with tertiary amyl phenol, i, 273.
Amylpiperidine, rotatory power of, ii, 149.
iso-Amylthiourea, Trans., 559.
iso-Amylurea, Trans., 564.
Anacylus Pyrethrum, active constituent of, Trans., 100.
Anæmia, the blood in, ii, 24.
Analyses, volumetric, notes on, ii, 134.
Analysis. Correction in the determination of the titre of a liquid holding a precipitate in suspension, ii, 135.
—— elementary, absorption apparatus for, ii, 417.
—— indirect methods of, ii, 32.
Anatase, preparation of artificial, ii, 21.
Andorite, a Hungarian silver ore, ii, 21,
Anethoïl, i, 341.

Anethoïl, action of bromine on, i, 341.
—— dibromide, brom-, i, 341.
Angelic acid, intramolecular change in, i, 205.
—— —— oxidation of, i, 205.
Angliceric acid, i, 205.
Anhaline, i, 120.
Anhydrides, mixed, i, 592.
Anhydro-α-amido-acids, ethereal salts of, i, 284.
Anhydrocamphoronic acid, brom-, i, 242.
—— anilide, i, 242.
—— chloride, i, 242.
—— —— brom-, i, 242.
"α-Anhydrocamphoronic acid," i, 242.
α-Anhydrodigitic acid, i, 66.
β-Anhydrodigitic acid, i, 66.
Anhydrodimethyltricarballylic acid, i, 478.
Anhydromorin sulphate, Trans., 649.
Anhydrotriacetophenone bisulphide, i, 362.
Anilidoacetanilidedicarboxylic acid, i, 144.
B_2-4-Anilidobenzeneinduline, i, 610.
γ-Anilidobutyrolactam, i, 177.
Anilidocaffeidine, i, 117.
Anilidocaffeïne, i, 116.
—— nitroso-, i, 117.
Anilidocollidine, i, 561.
Anilidoethylenedicarboxylic anilide, i, 561.
Anilidomaleïnanil, chloro-, i, 177.
Anilidomethylenecamphor, i, 63.
Anilido-*n*-methylrosinduline, i, 598.
Anilidomethyltriazolecarbamide, i, 573.
Anilidomethyltriazolethiocarbamide, i, 574.
Anilido-β-naphthalene-*m*-azobenzoic acid, i, 238.
—— —— ammonium base and betaïne from, i, 239.
Anilido-β-naphthalene-*o*-azobenzoic acid, i, 238.
—— —— ammonium base and betaïne from, i, 239.
Anilido-β-naphthalene-*p*-azobenzoic acid, i, 238.
—— —— ammonium base and betaïne from, i, 239.
Anilidonaphthazarin, trichloro-, i, 614.
Anilido-*n*-phenylethenylphenylenediamine, i, 600.
Anilido-*n*-phenyl-*o*-hydroxybenzenylphenylenediamine, i, 600.
Anilidophenylinduline, symmetrical, i, 611.
Aniline, action of nitrosobenzene on, Trans., 928.
—— 2 : 5-dibromo, action of nitrous acid on, Proc., **1895**, 109.
—— di-*o*-bromo-, i, 594.
Aniline 2 : 4-dinitro-, reduction of, i, 514.
—— hypochlorite reaction with, i, 24.
—— influence of temperature on the specific heat of, ii, 199.
—— *m*-nitro-, and acetanilide, melting points of mixtures of, Trans., 330.
—— —— and *m*-dinitrobenzene, melting points of mixtures of, Trans., 330.
Aniline, *m*-nitro-, preparation of, i, 657.
—— *o*-nitro-, manufacture of, i, 413.
—— *p*-nitro-, preparation of, i, 657.
—— *p*-nitroso-, salts of, i, 598.
—— organo-mercuric compounds derived from, i, 358.
—— *o*-sulphanilidobenzoate, i, 474.
—— *o*-sulphobenzoate, i, 472.
—— sulphur in, i, 24
—— 2 : 3 : 5 : 6-tetrabrom-, i, 345.
—— the bleaching powder reaction for, i, 132.
—— thio-, i, 132.
—— 3 : 4 : 5-tribrom-, i, 212.
Aniline-aposafranine, i, 528.
Aniline-*n*-oxychlorophosphine, *p*-chloro-, i, 364.
Aniline-*n*-phosphinic acid, *p*-chloro-, i, 364.
Anilines, nitro-, action of phthalic chloride on, i, 414.
—— *o*-nitro-, preparation of, i, 657.
Anilphenylglyoxylic acid, i, 594.
Anilpyruvic acid, i, 594.
Animal matter, estimation of iron in the ash of, ii, 89.
—— organism. See Organism, animal.
—— substances, examination of, for argon, ii, 516.
—— tissue, change of cyanogen compounds by, ii, 238.
—— —— oxidising action of, ii, 234.
Animals, hybernating, heat regulation in, ii, 452.
—— regulation of heat production in, ii, 232.
Anisenylamidoxime ethylic ether, i, 41.
Anisic acid, thermochemistry of, ii, 102.
Anisoïl, *p*-chlor-, i, 511.
—— dichloroseleno-, i, 341.
—— *o*-nitro-, compound of aluminium chloride with, i, 510.
—— *p*-nitro-, compound of aluminium chloride with, i, 510.
—— selenium derivatives of, i, 341.
—— seleno-, i, 341.
Anisylamidoacetal, i, 89.
Anniversary meeting, Trans., 1105.
Antholite from Elzivir, Colorado, ii, 116.
Anthracene and picric acid, solubility relations of a mixture of, ii, 71.
—— crude, estimation of paraffin in, ii, 423.

Anthracene, synthesis of, from ethylic trichloracetate and benzene, i, 379.
—— testing of, ii, 332.
Anthracenecarboxylic acids, etherification of, i, 228.
Anthracene-β-sulphinic acid, i, 671.
Anthracene-β-sulphonamide, i, 671.
Anthracene-β-sulphonanilide, i, 671.
Anthracene-β-sulphonedimethylanilide, i, 671.
Anthracene-β-sulphonephenylhydrazide, i, 671.
Anthracene-β-sulphonic acid, i, 671.
—— chloride, i, 671.
—— —— tetrabromo-, i, 671.
Anthracyl hydrosulphide, i, 671.
Anthagallol dimethyl ether from chay root, Trans., 819, 824.
Anthranil, derivatives of, i, 524.
—— 1 : 4-dichlor-, i, 524.
α-Anthrapyridine, i, 567.
β-Anthrapyridine, i, 567.
Anthraquinone, reduction of, by sodium ethoxide, i, 601.
—— ureïde from, i, 425.
1 : 2-Anthraquinone (β-anthraquinone), i, 544.
—— constitution of, i, 544.
Antimonic acid, solutions, action of hydrogen sulphide on, Trans., 515, 527, 534.
Antimoniocitric acid, salts of, Trans., 1030.
Antimonious oxide, action of, on citrates, Trans., 1030.
—— —— action of, on lactates, Trans., 1036.
—— —— action of, on malates, Trans., 1035.
—— —— action of, on mucates, Trans., 1036.
—— salts, action of oxidising agents on, Trans., 516.
Antimony chloride and hydrogen sulphide, reaction of, in the gaseous state, ii, 225.
—— estimation of, as tetroxide, ii, 372.
—— freezing point of, Trans., 186.
—— pentasulphide, action of heat on, Trans., 529.
—— —— action of light on, Trans., 528.
—— phenomena observed in the precipitation of, from solutions of tartar emetic, ii, 399.
—— potassium bromide, ii, 114.
—— —— chloride, Trans., 517; ii, 114.
—— separation of copper and lead from, ii, 422.
—— separation of lead, copper, silver, cadmium, cobalt, nickel, &c., from, ii, 89.
Antimony, separation of mercury from, ii, 532.
—— vermilion, ii, 114.
Antimony-gold alloy, ii, 392.
Antimony-palladium alloy, ii, 392.
Antimony-platinum alloy, ii, 391.
Antipyrine, i, 394, 571.
—— derivatives, i, 482.
—— patents, i, 432.
Antiseptic action of phenyl substituted fatty acids, ii, 58.
Apatite in a laminated graphite from Ceylon, and its estimation, ii, 22, 30.
Aphthalose from Vesuvius, ii, 115.
Apocinchonine, hydrochloro-, i, 630.
Apophyllite from Grängesberg, ii, 276.
Apoquinine and its rotatory power, i, 688.
—— salts, i, 436.
Aposafranine, i, 608.
—— action of aniline on, i, 527.
Apovellosidine and its salts, i, 195.
—— methiodide, i, 195.
Apovellosine and its salts, i, 195.
—— methiodide, i, 195.
Apovellosol hydrobromide and hydriodide, i, 195.
Apparatus, volumetric, instruments for the calibration and graduation of, ii, 134.
Apples, cider, oxidation of the tannin of, i, 386.
Aquotetraminexanthocobalt hydroxide, ii, 47.
—— salts, ii, 47.
Araban, i, 322.
α-Arabinochloral, i, 321.
β-Arabinochloral, i, 321.
Arabinose, action of hydrazine hydrate on, i, 409.
—— condensation of, with amidoguanidine, i, 409.
—— condensation of, with nitrobenzoylhydrazine, i, 409.
Arabinosediacetone, i, 440.
Arabinosehydrazonediphenyl, i, 97.
Arabinosenitrobenzoylhydrazide, i, 276.
Arginine, formation of, from keratin, i, 160.
Argon, action of, on carbon bisulphide ii, 498.
—— and helium type, gases of the, ii, 347.
—— attempts to combine with other elements, ii, 388.
—— combination of, with the elements of benzene, i, 412; ii, 469.
—— compound of, ii, 498.
—— demonstration of the presence of, in the atmosphere, ii, 347.
—— examination of animal and vegetable substances for, ii, 516.
—— fluorescence of, ii, 469.

Argon, fluorescence spectrum of, ii, 337, 469.
—— occurrence of, in the gases enclosed in rock salt, Proc., **1895**, 143.
—— spectrum, resemblance of, under certain conditions, to that of the Aurora borealis, ii, 337.
Arrow poisons, ii, 123.
Arsenic chloride and hydrogen sulphide, reaction of, in the gaseous state, ii, 225.
—— detection and estimation of small quantities of, in copper, ii, 31.
—— effect of, on vegetation, ii, 410.
—— estimation of, ii, 184, 329, 370, 415, 531.
—— estimation of, by means of thioacetic acid, ii, 370, 415.
—— estimation of, in organic matter, ii, 329.
—— estimation of small quantities of, ii, 531.
—— Schuller's yellow modification of, ii, 44.
—— separation of copper from, ii, 462.
—— separation of iron from, ii, 462.
—— separation of lead from, ii, 89, 462.
—— separation of lead, copper, silver, cadmium, cobalt, nickel, &c., from, ii, 89.
—— separation of mercury from, ii, 533.
—— separation of molybdenum, tungsten, and vanadium from, ii, 416.
—— separation of other elements from, by means of methylic alcohol and hydrogen chloride, ii, 415.
Arsenic acid, action of hydrogen sulphide on solutions of, Trans., 527, 533.
Arsenical pyrites, chemical behaviour of, ii, 17.
Arsenious acid, titration of, with permanganate, ii, 531.
—— anhydride, action of, on citrates, Trans., 1033.
—— —— action of, on lactates, Trans., 1036.
—— —— action of, on mucates, Trans., 1038.
—— —— action of, on potassium malate, Trans., 1036.
—— sulphide solutions, coagulation of, Trans., 63.
—— —— —— physical properties of, Trans., 63.
—— —— —— sp. gr. of, Trans., 71.
Arsenites, ii, 217.
—— aromatic, i, 340.
Artocarpus integrifolia (jack fruit tree), constituents of the wood of, Trans., 937.
Asbestos and associated minerals, ii, 116.
Ash of animal or vegetable matter, estimation of iron in, ii, 89.
Asparagine, action of nitrosyl chloride on, Trans., 491, 494.
—— m. p. of, ii, 379.
Aspartic acid, action of nitrosyl chloride on, Trans., 494.
—— —— m. p. of, ii, 379.
Asphaltum, analysis of, ii, 233.
Assimilation and transpiration in plants, ii, 175.
—— of lime in the body during disease, ii, 120.
—— of proteïds, influence of fats on, ii, 78.
—— vegetable, ii, 520.
Association hypothesis of chemical action, Trans., 1124.
Asymmetry, product of, Guye's formula for, ii, 473.
Atmosphere, attempts to estimate the sulphur in, Proc., **1894**, 218.
Atmospheres, extinctive, produced by flames, composition of, ii, 494.
—— which extinguish flame, composition of, ii, 443.
Atomic heat, rôle of, in the periodic series of the elements, ii, 198.
—— solution volumes, ii, 70.
—— volumes, ii, 107.
Atomic weight of bismuth, ii, 114.
—— —— of cerium, ii, 352, 353, 393.
—— —— of cobalt, ii, 167, 318.
—— —— of molybdenum, ii, 356.
—— —— of nickel, ii, 167, 318.
—— —— of oxygen, ii, 261.
—— —— of strontium, ii, 314.
—— —— of tellurium, Trans., 549,
—— —— of thallium, ii, 166.
—— —— of tungsten, ii, 230.
—— —— of yttrium, ii, 269.
—— —— relation of, to colour, ii, 442.
—— weights of hydrogen and oxygen, ratio on the, ii, 9.
—— —— prediction of, ii, 257, 440.
Atoms, ions and molecules, colour of, ii, 441.
a-iso-Atropic acid, i, 225.
β-iso-Atropic acid, i, 225.
Atropine, discrimination of, from strychnine, ii, 467.
Augelite from Machacamarca, Bolivia, ii, 507.
Aukylostomiasis, percentage of iron in the liver in, ii, 56.
Auramine, action of bromine on, i, 53.
—— derivatives of, i, 184.
—— pyrophosphomolybdate, ii, 275.
—— sodium pyrophosphate, ii, 274.
Auramineallylthiocarbimide, i, 185.
Auramineethylthiocarbimide, i, 185.
Auraminemethylthiocarbimide, i, 185.
Auraminephenylthiocarbimide, i, 185.
Aurin, action of bromine on, i, 56.

Azides of organic acids, i, 32.
Azimidocaffeïne, i, 116.
Azimido-compounds, i, 520.
Azimidoles, i, 136.
Azimidolesulphonic acid, i, 136.
Azimido-xylene, i, 520.
Azobenzene, *m*-amido-, Trans., 928.
p-Azobenzoylamidoacetal, i, 89.
o-Azobenzyl-*o*-toluidine, i, 307.
Azocamphanone-hydrazone, i, 382.
Azocamphene, i, 61.
Azo-colouring matters, i, 618.
Azo-compounds, Trans., 925; i, 520.
—— —— alkylated, and the theory of dyeing, i, 135.
—— —— reduction products of, i, 26.
Azodicarbonanil, i, 253.
2 : 1 : 4-Azodimethylnaphthalene, i, 425.
Azodithiourazole, i, 401.
Azoethyldithiourazole, i, 401.
Azoimides of organic acids, i, 32.
Azonium bases from 1-acetylamido-2 : 4-naphthaquinone and phenyl-*o*-phenylenediamine, i, 148.
Azophenyldithiourazole, i, 402.
Azo-series, isomerism in the, i, 351, 418.
o-Azoxybenzamide, i, 213.
Azoxybenzene, preparation of, i, 214.
Azoxybenzoic acid, dinitro-, i, 530.
p-Azoxybenzoic acid, i, 214.
o-Azoxybenzonitrile, i, 213.
p-Azoxybenzoylamidoacetal, i, 89.
Azoxystilbenedisulphonic acid, i, 287.

B.

Bacteria in the intestines, action of, ii, 453.
—— poisonous action of the hydroxybenzenes on, ii, 130.
—— thermophilic, ii, 58.
Bactericidal action of light and air, ii, 57.
Baddeleyite from Rakwana, Ceylon, ii, 505.
Balance sheet of the Chemical Society from March 16, 1894, till March 16, 1895, Trans., 1120.
Balance Sheet of the Research Fund from March 16, 1894, till March 16, 1895, Trans., 1121.
Balsam of Tolu, i, 188.
Barbatin, i, 299.
Barium antimoniocitrate, Trans., 1031.
—— arsenites, ii, 218.
—— chloride, m. p. of, ii, 36, 339.
—— —— mol. refraction of dissolved, Trans., 836, 844.
—— —— vapour pressure of the combined water in, ii, 486.
—— cupriferricyanide, i, 407.
Barium cuproferrocyanide, i, 407.
—— iodide, heat of formation of, ii, 342.
—— nitrate, mol. refraction of dissolved, Trans., 838, 846.
—— nitride, heat of dissolution of, ii, 255.
—— oxide, action of dry hydrogen chloride on, Proc., **1894**, 240.
—— —— compound of, with alcohol, ii, 342.
—— oxybromide, ii, 500.
—— oxyiodide, ii, 501.
—— phosphoduodecimolybdate, ii, 112.
—— *l*-propoxysuccinate, Trans., 956.
—— rottlerin, Trans., 235.
—— salts, poisoning by, ii, 322.
—— separation, qualitative, of calcium and strontium from, ii, 461.
—— specific ionic velocity of, ii, 477.
—— sulphate, the inclusion of barium chloride by, ii, 370.
—— tartrarsenite, Trans., 105.
—— triphosphate, ii, 446.
Barley, experiments on, at Grignon in 1894, ii, 179.
—— grain, effect of various phosphates on, ii, 181.
—— meal, effect of the degree of ripeness and of manures on the physical and chemical properties of, ii, 61.
—— variations in the sugars during the germination of, ii, 363.
Barometer, new form of, Trans., 129.
—— new laboratory, ii, 162.
Basanacantha spinosa var. ferox., crystalline constituent of, ii, 408.
Base from piperidylacetal alkyliodides, i, 479.
—— $C_8H_{16}N_2$, from the action of ethylenediamine on phorone, i, 328.
—— $C_9H_{16}N_2$, from triethylic cyanuride, i, 161.
Bases, aliphatic nitration of, i, 261.
—— aromatic nitroso-, i, 597.
—— —— sulphides and hydrosulphides of, i, 300.
—— complex metallic, i, 199.
—— from coal-tar, i, 390.
—— metallic, affinity of, Trans., 585.
—— organic, affinity of, Trans., 582.
—— —— lead double salts of, i, 390.
—— —— nitration of, i, 273.
—— —— of some agricultural seeds, oil cakes, tubers, and some seedlings, ii, 364.
—— —— relative affinities of, in alcoholic solution, ii, 259.
—— weak affinities of, Trans., 576.
Basswood oil, ii, 285.
Bath, air-, made of aluminium, ii, 9.
—— water-, ii, 163.
—— —— constant level, ii, 216.

Battery, gas, ii, 150, 251.
—— thermochemical carbon, ii, 302.
Baumann-Schotten method, modification of, i, 461.
Bauxite, new element from, ii, 313.
Bay oil, constituents of, ii, 540.
—— —— detection of adulteration of, ii, 540.
Beer wort, amorphous nitrogenous constituents of, ii, 428.
—— —— estimation of cane sugar in, ii, 93.
Beeswax, free acids from, i, 81.
Beet, sugar-, changes in when attacked by *Heterodera Schachtii*, ii, 524.
—— —— digestion of, ii, 452.
Beetroot, effect of various phosphates on, ii, 180.
—— occurrence of oxalic acid in, ii, 177.
Behenic acid, oxy-, constitution of, i, 16.
Behenolic acid, action of fused potash on, i, 126.
Behenoxylic acid, i, 208.
Benzacetodinitrile, action of carbanil on, i, 584.
—— nitrite, i, 584.
Benzaconine, acetyl derivatives of, Trans., 459.
Benzaldehyde, action of α-phenylsemicarbazide on, Trans., 1063; Proc., **1895**, 124.
—— addition of hydrogen cyanide to, i, 464.
—— *m*-bromo-, oxime and phenylhydrazone of, i, 282.
—— 3 : 6-bromonitro- and its oxime and phenylhydrazone, i, 282.
—— combination of, with hydrogen cyanide in dilute solution, i, 419.
—— condensation of, with glutaric acid, i, 141.
—— freezing point of, i, 272; ii, 207.
—— sulphone of, i, 285.
Benzaldehydomethylcarbamide, i, 433.
Benzaldehydo-*o*-oxamic acid, i, 251.
Benzaldoxime, action of thionyl chloride on, ii, 44.
—— benzyl ether, i, 461.
—— *m*-bromo-, i, 282.
—— 3 : 6-bromonitro-, i, 282.
Benzaldoximes, action of phosphorus pentachloride on, Proc., **1895**, 149.
—— ethers of, Proc., **1895**, 149.
—— isomerism of, Proc., **1895**, 149.
Benzamide, action of nitrosyl chloride on, Trans., 490.
—— 2 : 4-dibromo-, Trans., 603.
—— 2 : 6-dibromo-, Trans., 595, 603.
—— —— hydrolysis of, Trans., 603.
—— 3 : 5-dibromo-, Trans., 594.
Benzamide, electrolysis of, i, 209.
—— heat of formation of, ii, 483.
—— *m*-nitro-, i, 344.
—— *o*-nitro-, i, 345.
—— preparation of the sodium derivative of, i, 289.
—— syntheses with the sodium derivative of, i, 289.
—— 2 : 4 : 6-tribromo-, Trans., 597.
—— 3 : 4 : 5-tribromo-, Trans., 596.
Benzamidine, amido-, salts of, i, 266.
Benzamidinediazobenzene, amido-, i, 266.
—— *m*-nitro-, i, 266.
Benzamidinediurethane, amido-, i, 266.
Benzamidineurethane, *m*-nitro-, i, 266.
Benzanilide, heat of formation of, ii, 483.
—— preparation of, i, 360.
Benzene, action of camphoric anhydride on, in presence of aluminium chloride, i, 108.
—— *p*-bromonitroso-, i, 459.
—— chlor-*p*-iodo-, iodonium bases from, i, 221.
—— condensation of, with benzylidene chloride, Trans., 829.
—— condensation of, with chloroform, Trans., 829; i, 278.
—— condensation of, with glyoxylic acid, i, 526.
—— derivatives, solubility of, in water, ii, 489.
—— *p*-dibromo-, reaction of, with *p*-toluidine, i, 292.
—— *m*-dinitro-, action of alcoholic potassium cyanide on, i, 654.
—— —— and acetanilide, melting points of mixtures of, Trans., 331.
—— —— and *m*-nitraniline, melting points of mixtures of, Trans., 330.
—— —— compound of aluminium chloride with, i, 510.
—— estimation of thiophen in, i, 411; ii, 372.
—— formula of, i, 339.
—— hexachloro-, *p*-dichloride, i, 24, 652.
—— molecule, configuration of, i, 53.
—— nitro-, compound of aluminium chloride with, i, 510.
—— nitroso-, action of, on aniline and on phenylhydrazine, Trans., 928.
—— 2 : 3 : 5 : 6-tetrabromonitro-, i, 345.
—— tetramido-, condensation of, with benzile, i, 477.
—— tribromo-unsymmetrical, i, 212.
—— 1 : 3 : 5-trinitro-, additive compounds of, with bases, i, 652.
—— —— colouring matter formed by the action of alkalis on, i, 653.

m-Benzeneazo-*o*-acetyltoluidide, Trans., 932.
p-Benzeneazo-*o*-acetyltoluidide, Trans., 931.
Benzeneazocyanomaclurin, Trans., 942.
1 : 3 : 4-Benzeneazodihydroxynaphthalene, i, 617.
1 : 3 : 4-Benzeneazodiketodihydronaphthalene, i, 617.
Benzeneazodiphenyltetrazolium chloride, i, 75.
Benzeneazomaclurin, Trans., 933.
—— dyeing properties of, Trans., 936.
—— *p*-nitro-, Trans., 934.
Benzeneazo-β-naphthaquinol, i, 617.
Benzeneazo-β-naphthaquinone, i, 617.
Benzene-*p*-azonaphthylamine, i, 669.
Benzeneazo-β-naphthylphenylamine, i, 238.
Benzeneazophenol, *m*-bromo-, i, 353.
—— *m*-chloro-, derivatives of, i, 353.
—— *o*-chloro-, derivatives of, i, 353.
—— *m*-chloronitro-, i, 353.
—— *o*-chloronitro-, i, 353.
Benzeneazophenols, halogenised, i, 353.
Benzeneazophenylmethane, nitro-, i, 455.
Benzeneazo-1-phenylpyrazoline, i, 249.
Benzeneazosalicylic acid, *m*-chloro-, i, 353.
p-Benzeneazotoluene, Trans., 929.
—— *m*-amido-, Trans., 932.
p-Benzeneazotoluenesulphonic acid, Trans., 930.
—— chloride, Trans., 930.
Benzeneazoxindone, amido-, i, 220.
Benzenediazocarboxylamide, *p*-chloro, i, 658.
—— *p*-nitro-, i, 658.
Benzenediazocarboxylic acid, *p*-chloro-, potassium salt of, i, 658.
—— —— *p*-nitro- potassium salt of, i, 658.
—— acids, derivatives of, i, 658.
Benzenediazocarboxylimidoethyl ether, nitro-, i, 658.
Benzenediazocarboxylimidomethyl ether, chloro-, i, 659.
—— —— nitro-, i, 659.
Benzenediazonium bromide, *p*-bromo-, i, 519.
—— —— *o*-chloro, i, 519.
—— —— *p*-nitro-, i, 519.
Benzenediazonium mercurochloride, i, 517.
—— —— *p*-chloro-, i, 517.
Benzene-*anti*-diazosulphonic acid, *o*-chloro-, potassium salt of, i, 181.
—— —— *p*-chloro-, potassium salt of, i, 181.
Benzene-*syn*-diazosulphonic acid, *p*-bromo- and *p*-chloro-, potassium salts of, i, 181.
Benzene-*syn*-diazosulphonic acid, *o*-chloro-, potassium salt of, i, 181.
Benzenediazosulphonic acids, salts of stereoisomeric, i, 25, 26.
Benzenehydrazocarbamide, chloro-, i, 659.
Benzenehydrazothiocarbamide, chloro-, i, 659.
Benzeneindone, amido-, i, 610.
Benzeneinduline hydrochloride, real nature of, i, 528.
Benzenesulphodiamidodi-*o*-toluidide, i, 595.
Benzenesulphodinitro-*o*-toluidide, i, 595.
Benzenesulphonic acid, *m*-iodo-, i, 230.
—— —— *o*-iodoso, sodium salt of, i, 231.
—— chloride, *m*-iododichloride, i, 230.
—— —— *o*-iododichloride, i, 230.
—— —— *p*-iododichloride, i, 230.
Benzenesulphonic ether of ethylnitrolic acid, i, 456.
Benzenesulpho-*o*-toluidide, i, 595.
—— dinitro-, i, 595.
Benzenyl-*o*-amido-*p*-cresol, *m*- and *p*-, amido-, i, 415.
Benzenylamidophenols, amido-derivatives of, i, 415.
Benzenylamidothiophenol, i, 347.
—— nitro-, i, 347.
Benzenylamidoxime, di-*m*-nitro-, i, 662.
—— methylic ether, i, 41.
—— *o*-nitro-, i, 88, 212.
—— *p*-nitro-, i, 88.
—— propylic ether, i, 41.
Benzenylamidoxime-*iso*-butyric acid, i, 522.
—— esoanhydride, i, 521.
α-Benzenylamidoximepropionic acid, i, 125.
—— esoanhydride, i, 125.
Benzenylazoximethiocarbinol, i, 662.
α-Benzenylchloroximepropionic acid, i, 125.
α-Benzenylchloroxime-*iso*-butyric acid, i, 522.
Benzenyldiphenyldiureïde, *m*-nitro-, i, 266.
Benzenylhydrazimidobenzylidene, hydrobromide, i, 661.
—— hydrochloride, i, 662.
Benzenylhydrazoximido-*m*-nitrobenzylidene hydrobromide, *m*-nitro-, i, 662.
—— —— dibromide, i, 662.
Benzenylpiperidoxime, *m*-, *o*-, and *p*-nitro, i, 88.
Benzethylacethydroxylamine, i, 40.
Benzethylcarbethoxyhydroxylamine, i, 41.
Benzethylphthalylhydroxylamine, i, 41.
Benzethylsuccinylhydroxylamine, i, 41.
Benzethyl-*p*-toluhydroxylamine, i, 41.

Benzhydroximic chloride, *m*-, *o*-, and *p*-nitro, i, 88.
Benzile, action of benzylamine on, Trans., 35.
—— action of ethylamine on, Trans., 43.
—— condensation of, with ethylic acetoacetate, Proc., 1895, 146.
—— condensation of, with ethylic malonate, Trans., 132.
—— condensation of, with tetramidobenzene, i, 477.
Benziledibenzoylhydrazone, i, 35.
Benziledioxime peroxide, *m*- and *p*-dinitro-, i, 88.
α-Benzileosazone, Trans., 611.
—— conversion of, into the β-modification, Trans., 612.
β-Benzileosazone, Trans., 614.
Benzimidomethyl ether, i, 522.
—— —— action of, on aromatic *o*-compounds, i, 522.
Benzimidophenylthiocarbamide, *m*-nitro-, i, 266.
Benzimidophenylureide, nitro-, i, 266.
Benzoic acid, *o*-amido, action of, on quinone, i, 466.
—— —— *p*-amido-, reduction of, i, 91.
—— —— *p*-bromo-, salts of, i, 150.
—— —— 6 : 2-chloronitro-, i, 228.
—— —— *p*-chloro-*m*-sulpho-, derivatives of, i, 181.
—— —— 3 : 5-diamido, i, 531.
—— —— 2 : 6-dibromo, Trans., 603.
—— —— —— m. p. of., i, 466.
—— —— 3 : 5-dinitro-, coloured alkaline solutions of, i, 530.
—— —— di- and tri-nitro, colour reaction of, i, 91.
—— —— *p*-nitro-, i, 178.
—— —— —— electrolytic reduction of, i, 178.
Benzoic acids, amido-, action of pyruvic acid and benzaldehyde on, i, 71.
—— —— —— reactions of, i, 280.
—— —— diortho-substituted, Trans., 587, 601.
—— —— isomeric substituted, velocity of etherification of, i, 467.
—— —— nitro-, reactions of, i, 364.
—— —— —— thermal properties of, ii, 202.
Benzoic anhydride, preparation of, i, 139, 178.
Benzoic chloride, *m*-bromo-, and its stability towards bases, Trans., 590.
—— —— *o*-bromo-, and its stability towards bases, Trans., 589.
—— —— *p*-bromo-, and its stability towards bases, Trans., 591.
—— —— 2 : 4-dibromo-, and its stability towards bases, Trans., 592.
Benzoic chloride, 2 : 6-dibromo, and its stability towards bases, Trans., 594.
—— —— 3 : 5-dibromo, and its stability towards bases, Trans., 593.
—— —— 2 : 6-dinitro-, and its stability towards bases, Trans., 599.
—— —— freezing point of, ii, 207.
—— —— *o*- and *p*-nitro-, action of amidoacetal on, i, 88.
—— —— reduction of, Proc., 1894, 216.
—— —— 2 : 3 : 4 : 6-tetrabromo- and its stability towards bases, Trans., 597.
—— —— 2 : 4 : 6-tribromo- and its stability towards bases, Trans., 596.
—— —— 3 : 4 : 5-tribromo- and its stability towards bases, Trans., 595.
—— —— 2 ; 4 : 6-trinitro-, i, 91.
—— —— —— and its stability towards bases, Trans., 600.
—— chlorides, substituted, Trans., 587.
o-Benzoicsulphinide, crystallography of, Trans , 985.
Benzoïn, action of aniline bases on, i, 46.
—— condensation of, with monosubstituted derivatives of carbamide and thiocarbamide, i, 305.
—— condensation of, with thiocarbamide, ammonium thiocyanate, or carbamide, i, 304.
Benzoïnhydrazine, i, 606.
Benzoïnketazine, i, 607.
Benzonitrile, *o*-amido-, i, 212.
—— *p*-chloro, i, 348.
—— compounds of aluminium chloride with, i, 636.
—— *o*-nitro-, i, 212.
Benzonitriles, nitro-, attempts to polymerise, i, 344.
—— substituted, i, 344.
Benzophenacetonitrile, i, 585.
Benzophenone, *o*-amido-, preparation of, i, 147.
—— constitution of isomeric symmetrical di-derivatives of, i, 232.
—— 2 : 2′-diamido, i, 147.
—— 2 : 3′-diamido-, i, 233.
—— 4 : 2′-diamido-, i, 233.
—— labile, i, 476.
—— nitramido-, (2 : 3′ or 3′ : 2), i, 233.
Benzophenonedicarboxylic acid, i, 422.
Benzophenoneoxime, oxidation of, in air, i, 475.
Benzopropiodinitrile, action of hydroxylamine on, i, 584.
Benzotrichloride, freezing point of, i, 272 ; ii, 207.
Benzoxymethylenecamphor, i, 64.
Benzoxymethylenementhone, i, 65.

Benzoylacetone, action of sulphur chloride on the copper derivative of, i, 168.
—— *p*-aniside of, i, 431.
—— dithio-, i, 169.
Benzoylaldehyde, condensation of, with hydrazine, i, 395.
Benzoylamidoacetal, *o*-amido-, i, 88.
—— *o*-nitro-, i, 88.
—— *p*-nitro-, i, 89.
o-Benzoylamidoacetalcarboxylic acid, i, 90.
Benzoylamidobenzaldehyde, i, 250.
o-Benzoylamidobenzylaniline, i, 191.
o-Benzoylamidobenzylic chloride, i, 191.
p-Benzoylamidobenzylic alcohol, i, 344.
Benzoylamidocinnamic acid, lactimide of, i, 281.
Benzoylamidodiphenylenepyrodiazoline, i, 213.
o-Benzoylamidodiphenylmethane, i, 53.
o-Benzoylamidophenylauramine, i, 185.
Benzoylamylnitrolic acid, i, 456.
Benzoylanilidocaffeïne, i, 117.
Benzoylatropine, i, 158.
Benzoylauramine, i, 185.
Benzoylazimidotoluene, i, 520.
Benzoyl-*m*-azo-*p*-toluidine, i, 520.
Benzoylazo-xylidine, i, 520.
Benzoylbenzene-*p*-azonaphthylamine, i, 669.
o-Benzoylbenzenesulphonic acid, i, 475.
Benzoylbenzylamine, synthesis of, i, 289.
Benzoylbenzylidenetoluidine, i, 666.
—— oxime of, i, 666.
Benzoylbromophenylcysteïn, i, 284.
Benzoylcarbamide, behaviour of, in the animal organism, ii, 280.
Benzoylcarbinol, methylation of, i, 440.
Benzoylcarvylamine, i, 152.
Benzoyl-α-chloro-β-naphthyl methyl ether, i, 511.
Benzoylcinchonine, i, 483.
Benzoylcinchotenine, i, 403, 483.
β-Benzoylcinnamic acid, Trans., 137.
Benzoylcotoïn, i, 110.
Benzoyl-*p*-diamidophenylic sulphide, i, 87.
Benzoyldiazobenzene-*p*-acetotoluidide, i, 347.
Benzoyldihydroeucarvylamine, i, 152.
Benzoyldihydrophenotriazine, compounds of, with β-naphthol and dimethylaniline, i, 308.
Benzoyl-1 : 4-dimethylglyoxalidine, i, 482.
Benzoyldimethylthiophen, i, 509.
Benzoyldimethylthiophen, bromo- and its oxime, i, 509.
Benzoyldiphenylketipamidonitrile, i, 102.
Benzoyl-1 : 5-diphenyl-3-oxytriazole, Trans., 1066.
Benzoylethylidenetetramethyldi-*m*-amidophenol, 1, 147.
Benzoylethyl-*o*-*p*-tolylenediamine, i, 599.
Benzoylformic acid, *p*-bromo-, i, 218.
—— —— —— hydrazone of, i, 218.
—— —— —— ureide of, i, 218.
—— —— phenylhydrazone of, i, 687.
Benzoylglyoxaline, new synthesis of, i, 568.
Benzoylhydrazine, i, 34.
—— *m*-nitro-, i, 276.
—— *o*-nitro-, i, 276.
—— *p*-nitro-, i, 276.
Benzoylhyoscyamine, i, 158.
Benzoylimide, di-*m*-nitro-, i, 344.
Benzoylimidoacetylpropionitrile, i, 584.
Benzoylluteol, i, 573.
Benzoylmaltol, i, 80.
Benzoylmethanehydrazomethane, i, 263.
1 : 3-Benzoylmethyl-5-dimethylpyrazoline, i, 249.
Benzoyl-4 : 1-methylethylglyoxalidine, i, 482.
Benzoyl-*p*-methylisatic acid, i, 400.
—— amide, i, 400.
Benzoyl-*p*-methylisatin, i, 400.
Benzoyl-2 : 6-methylphenylpiperidine, i, 563.
Benzoylmethylsulphone-ethylamine, i, 85.
Benzoylnaphthylidenephenylhydrazone, i, 240.
Benzoylnorgranatanine, i, 160.
Benzoyl-*o*-phenolbenzylamine, i, 372, 537.
Benzoyl-*p*-phenylauramine, i, 184.
β-Benzoyl-α-phenylbenzoic acid, i, 179.
Benzoylphenylcarbamide, i, 289.
Benzoylphenyl-*o*-cresolamine, i, 372, 537.
Benzoylphenylcyanamide, i, 462.
Benzoyl-β-phenyl-αγ-diketohydrindene, i, 536.
Benzoyl-*cyclo*-phenylenebenzylidene oxide, i, 537.
Benzoylphenylglycoline, i, 155.
Benzoylphenylhydrazine, action of magnesium on, Proc., **1895**, 10.
β-Benzoyl-α-phenylpropionic acid, i, 361.
—— anhydride, i, 361.
β-Benzoyl-α-phenylpropionitrile, i, 179, 361.
Benzoyl-4′-phenyltetrahydroquinoline, i, 431.
Benzoylphenyl-*p*-tolylbenzenylamidine, i, 347.

Benzoylphenyl-*p*-tolylethenylamidine, i, 347.
Benzoylphyscion, i, 299.
Benzoylpropionic acid, products of the reduction of, i, 533.
1-Benzoylpyrazole, i, 397.
Benzoylquinine, i, 118.
Benzoylsarcosine, i, 176.
Benzoylscopolamine, i, 158.
Benzoylscopoleïne, i, 632.
Benzoylsordidin, i, 388.
Benzoyl-*p*-tolenylhydrazidine, i, 137.
Benzoyl-*p*-toluacetodinitrile, i, 585.
Benzoyltoluresinotannol, i, 189.
Benzoyl-β-*m*-tolyl-αγ-diketohydrindene, i, 535.
Benzoyl-*iso*-undecylamine, i, 324.
Benzoylvestrylamine, i, 152.
Benz-*iso*-thiazole, i, 432.
Benz-*p*-toluhydroxamic acid, i, 39.
Benzyl ethers of oximes, i, 461.
Benzylacetamide, *o*-chloro-, i, 308.
Benzylacetoacetamide, i, 141.
ω-Benzylacetophenone, β-bromo-, i, 361.
—— β-chloro-, i, 361.
—— —— action of aniline and *p*-toluidine on, i, 361.
Benzyl-*o*-amidobenzylaniline, i, 133.
—— action of carbonyl chloride on, i, 134.
—— hydrazine and hydrazone of, i, 133.
—— nitroso-, i, 133.
Benzyl-β-amidocrotonbenzylamide, i, 141,
Benzylamine, action of benzile on, Trans., 35.
—— action of, on ethylic acetoacetate, i, 140.
—— action of, on phenanthraquinone, Trans., 46.
—— *o*-amido-, i, 306, 307.
—— derivatives of, i, 414.
—— hydrogen oxalate, i, 457.
Benzylammonium benzyloxamate, i, 457.
Benzylanilidophenylsulphone, *o*-amido-, i, 307.
—— *o*-nitro-, i, 307.
Benzylbenzamide, i, 53.
—— *o*-bromo-, *o*-chloro-, and *o*-iodo-, i, 308.
Benzylcamphor, oxidation and nitration of, i, 678.
Benzylcysteïn, i, 624.
Benzyldiphenylhydrazine, *o*-nitro, i, 354.
o-Benzylene-ψ-thiocarbamide, i, 432.
"*p*-Benzylenimide," i, 523.
Benzylethylamine, *o*-amido-, salts of, i, 306.
Benzylformamide, i, 457.
Benzylglutaric acid, bromo- and dibromo-, i, 142.
Benzylglutaric acids, i, 141.
Benzylglycolylhydrazine, i, 332.
Benzylhydrazines, *o*-amido-, i, 31.
Benzylic alcohol, *p*-amido-, i, 343.
—— arsenite, i, 340.
—— ψ-benzylimidodicarboxylate, trithio-, i, 605.
—— bisulphide, *o*-amido-, i, 432.
—— bromide, *o*-amido-hydrobromide, i, 190.
—— carbaminthiolate, *o*-nitro-, i, 432.
—— chloride, *o*-amido-, hydrochloride, i, 190.
—— —— as a desulphurising agent, i, 461.
—— —— freezing point of, i, 272.
—— chlorides, nitro-, reduction of, i, 344.
—— hydrosulphide, *o*-amido-, i, 432.
—— imidotrithiodicarboxylate, i, 419.
—— nitrite, i, 455.
—— quinaldine-β-carboxylate and its methiodide, i, 113.
—— quinoline-1-sulphonate, i, 111.
—— sulphide, *o*-amido-, i, 191.
—— —— *p*-bisazo-α-naphthol, i, 457.
—— —— *p*-bisazo-β-naphthol, i, 457.
—— —— *p*-bisazoresorcinol, i, 457.
—— —— di-*p*-amido-, i, 343, 457.
—— —— —— phthalide of, i, 457.
—— —— di-*p*-nitro-, i, 457.
—— thioallophanate, i, 462, 605.
—— thiocyanate, *o*-nitro-, derivatives of, i, 432.
Benzylidene bromide, sulphone of, i, 285.
—— chloride, freezing point of, ii, 207.
—— cyanhydrin, action of hydrazine hydrate on, i, 602.
Benzylideneacethydrazide, i, 263.
Benzylideneacetone, dichloro-, i, 529.
Benzylideneacetobenzoylhydrazone, i, 35.
Benzylideneacetoneoxime, action of phosphoric anhydride on, i, 392.
Benzylideneacetoxime, chloro-, i, 529.
Benzylideneacetophenone, nitro-, i, 422.
—— *o*-nitro-, i, 422.
Benzylideneacetophenoneoxime, i, 361.
—— bromo-, i, 361.
Benzylideneacetophenoneoximes, i, 422.
Benzylideneacetylacetone, i, 50.
Benzylideneacetylcreatinine, i, 310,
Benzylidene-*p*-amidobenzylic alcohol, i, 344.
—— sulphide, *p*-nitro-, i, 457.
Benzylidene-*o*-amidophenylmethane, *p*-nitro-, i, 53.
Benzylideneamidophenyl-α-naphthylamine, i, 601.
—— *m*-nitro-, i, 601.

4-Benzylideneamido-3-phenylpyrazolone, i, 686.
Benzylidenebenzacetodinitrile, i, 584.
Benzylidenebenzoïnazine, i, 607.
—— *m*-nitro-, i, 607.
—— *o*-nitro-, i, 607.
Benzylidenebenzoylhydrazine, i, 35.
—— *m*-nitro-, i, 35.
Benzylidenebenzylglycolylhydrazine, i, 332.
4-Benzylidenebis-3 : 4-dimethylpyrazolone, i, 687.
Benzylidenebis-3 : 1 : 5-methylphenylpyrazolone, i, 395.
Benzylidenebiuret, behaviour of, in the animal organism, ii, 280.
Benzylidenecamphor, oxidation and nitration of, i, 678.
Benzylidenecarbohydrazimine, i, 30.
Benzylidenediacetylacetone, i, 50.
—— action of hydrogen chloride on, i, 50.
Benzylidenedicarbamide, i, 12.
Benzylidene-3 : 5-dimethyl-Δ_2-ketotetrahydrobenzene, i, 52.
Benzylidene-2 : 4-dinitrophenylhydrazine, i, 27, 29.
—— *m*-nitro-, i, 28.
—— *o*-nitro-, i, 27.
Benzylidene-4′-*o*-ethoxyphenylquinaldinesulphonic acid, i, 114.
Benzylideneformylhydrazine, i, 263.
Benzylidenefurfurylhydrazidine, i, 270.
Benzylideneglutaric acid, i, 141.
Benzylideneglycolylhydrazine, i, 332.
Benzylidenehydrazidocaffeïne, i, 116.
Benzylidenehydrazidodiphenyl, i, 97.
Benzylidene-4′-*m*-hydroxyquinaldinesulphonic acid, i, 114.
Benzylidenic chloride, freezing point of, i, 272.
Benzylidenemalonamide, i, 651.
Benzylidenemalonic acid, action of bromine on, i, 227.
Benzylidenemalononitrile, i, 651.
Benzylidenemalonylhydrazine, i, 263.
4 : 3-Benzylidenemethylpyrazolone, i, 246.
Benzylidenenitrile glucoside, i, 554.
Benzylidene-*m*-nitrobenzoylhydrazine, i, 276.
Benzylidene-*o*-nitrobenzoylhydrazine, i, 276.
Benzylidene-*p*-nitrobenzoylhydrazine, i, 276.
Benzylideneoxalylhydrazine, i, 264.
Benzylidenephenyl-μ-amidophenylinduline, i, 609.
Benzylidenephenylhydrazone, action of iodine and sodium ethoxide on, Trans., 606, 611.
Benzylidenephenylhydrazone, oxidation of, with amylic nitrite, Trans., 615.
Benzylidene-1-phenylpyrazoline, i, 249.
Benzylidene-1 : 5-phenylpyrazolone, i, 193.
4-Benzylidene-3-phenylpyrazolone, i, 686.
1 : 2-Benzylidene-3-phenylpyrazolone-4-azobenzene, i, 687.
Benzylidenepicrylhydrazine, i, 28, 30.
—— *m*- and *o*-nitro-, i, 28.
Benzylidenepyridazolone-4-carbonylhydrazine, i, 302.
Benzylidenesemicarbazide, *o*-, *m*-, and *p*-nitro-, i, 251.
Benzylidenesuccinylhydrazine, i, 264.
Benzylidene-*p*-tolenylhydrazidine, i, 137.
Benzylidene-*p*-toluacetodinitrile, i, 585.
Benzylidene-*o*-*p*-tolylenediamine, *m*-nitro-, i, 599.
—— *o*-nitro-, i, 598.
—— *p*-nitro-, i, 599.
Benzylidenetrimethyldihydroquinoline, i, 69.
Benzylidene-*iso*-undecylamine, i, 324.
Benzyl-β-imidobutyrobenzylamide, i, 141.
Benzyllophine, Trans., 38.
Benzylnaphthalimide, i, 239.
Benzyl-*o*-nitrobenzylideneaniline, *o*-amido-, i, 134.
Benzylnitrosoaniline, *o*-nitro-, i, 31.
o-Benzyloxy-*p*-*iso*-butylbenzaldehyde, i, 222.
Benzyloxymethylenecamphor, i, 64.
Benzyl-*p*-phenetylhydrazine, *o*-amido-, i, 32.
—— *o*-nitro-, i, 32.
β-Benzylpheno-*m*-diazine, i, 251.
Benzylphenylhydrazine, *o*-amido-, i, 31.
—— —— action of phosgene and of carbon bisulphide on, i, 31.
Benzylphenylnitrosamine, *o*-nitro-, i, 31.
Benzylquinoline, i, 481.
Benzyl-*o*-toluidine, *o*-amido-, i, 307.
Benzyl-*p*-toluidophenylsulphone, *o*-nitro-, i, 307.
ab-Benzyl-*m*-tolylcarbamide, Trans., 563.
ab-Benzyl-*o*-tolylcarbamide, Trans., 562.
1 : *n*-Benzyl-2 : *n*-tolyldihydronaphthimidazole, i, 59.
1-Benzyl-2-tolylnaphthylenediamine, i, 58.
Benzyl-*o*-tolylnitrosamine, *o*-amido-, i, 308.
—— *o*-nitro-, i, 308.
ab-Benzyl-*m*-tolylurea, Trans., 563.
ab-Benzyl-*o*-tolylurea, Trans., 562.
Benzyltriacetonamine, i, 328.

Benzyltripiperidine-*n*-phosphonium chloride, i, 683.
Beryl from Pisek, ii, 173.
Beryllium acetylacetonate, ii, 224.
—— valency of, ii, 224.
Bessemer process, spectroscopic phenomena and thermochemistry of, ii, 432.
Betaïne, occurrence of, in agricultural seeds, &c., ii, 364.
Betula lenta, gaultherin, a new glucoside from, i, 109.
Biatora lucida, pigment from, i, 298.
Bile pigment, detection of, in urine, ii, 336.
Bisbenzoylphenylazimethylene, i, 607.
Bis-*p*-dimethylamidobenzylidene-*p*-phenylenediamine, i, 213.
Bisdimethylamidophenyl-acetic acid, i, 171.
Bisethylphenylsulphone, i, 286.
Bishydrazicarbonyl (dicarbamide), i, 12.
Bishydroquinoline, nitrosamine from, i, 69.
4-Bis-5 : 2 : 1-methoxymethylphenylpyrazole, i, 397.
4-Bis-3-methylpyrazolone, i, 247.
Bismuth arsenite, ii, 218.
—— atomic weight of, ii, 114.
—— bromide, action of hydrogen sulphide on, Trans., 91.
—— chloride, action of hydrogen sulphide on, Trans., 91.
—— —— compound of, with nitric oxide, ii, 495.
—— cresotates, i, 92.
—— haloïd compounds, action of hydrogen sulphide on, Trans., 90.
—— hypophosphite, Trans., 227, 229.
—— liquation caused in standard gold by the presence of, Trans., 552.
—— nitrosalicylates, i, 179.
—— potassium sulphide, ii, 273.
—— selenide, crystallisation of, ii, 391.
—— separation of cadmium from, ii, 331.
—— separation of cobalt from, ii, 422, 423.
—— separation of lead from, ii, 536.
—— separation of mercury from, ii, 332, 533.
—— separation of nickel from, ii, 422.
—— silver sulphide, ii, 391.
—— sulphide, ii, 273.
—— —— action of bromine on, Trans., 92.
—— —— action of chlorine on, Trans., 92.
—— —— crystallisation of, ii, 391.
—— —— solubility of, in potassium sulphide, ii, 273.
—— tartrate, i, 92.
Bismuth thiobromide, Trans., 91.
—— thiochloride, Trans., 91.
—— thiohaloïd compounds, analysis of, Trans., 93.
—— thioiodide, Trans., 92.
Bismuth-gold alloy, ii, 392.
Bismuthinite from Rosario District, Sinaloa, Mexico, ii, 511.
Bismuth-palladium alloy, ii, 392.
Bismuth-platinum alloy, ii, 392.
Bisphenylazo-α-naphthol di-*p*-bromo-, i, 619.
Bisphenylbenzylazimethylene, i, 608.
Bisphenylpyrazoline, i, 249.
Bis-1 : 5-phenylpyrazolone-4-β-propionic acid, i, 395.
Bisphenylsulphone-propane, i, 230.
Bis-*iso*-propylphenylsulphone, i, 286.
Bispyrazolone from ethylic ketipate osazone, i, 173.
Bis-*p*-tolylazo-α-naphthol, i, 618.
Bis-β-*m*-tolyl-αγ-diketohydrindene, i, 536.
Bis-*p*-tolylsulphone-propane, i, 230.
"Bisulphazolidine," i, 576.
Bitumens, origin of, ii, 115.
Biuramine, i, 418.
Biuret, behaviour of, in the animal organism, ii, 280.
Biuretdimethylene, i, 446.
Bleaching powder, detection and estimation of chlorate in, ii, 527.
Blende, cadmiferous, from Mies, Bohemia, ii, 505.
Blood, action of intravenous injection of sodium chloride on the composition of, ii, 173, 362.
—— action of, on starch, ii, 403.
—— alkalinity of, ii, 121.
—— arterial and venous, urea in, ii, 236.
—— coagulation of the, ii, 52.
—— corpuscles, estimation of, ii, 122.
—— —— red, percentage of nitrogen in, in health and disease, ii, 24.
—— defibrinated, amount of nitrogen in, ii, 123,
—— disappearance of leucocytes from, after the injection of peptone, ii, 79.
—— estimation of fibrin in, ii, 300.
—— estimation of urea in, ii, 299.
—— gases, exchange of, in brain and muscle, ii, 231, 405.
—— —— influence of the intravenous injection of *d*-glucose on, ii, 76.
—— —— of brain and muscle in rest and activity, ii, 231.
—— *d*-glucose in, ii, 405.
—— glycogen in the, ii, 233.
—— glycolysis in, ii, 361.
—— human, in disease, ii, 123.

Blood in anæmia, ii, 24.
—— in cancer, ii, 280.
—— influence of carbonic anhydride and oxygen on the coagulation of, ii, 78.
—— leucæmic, ii, 123.
—— neurine in, ii, 454.
—— serum, determination of the osmotic pressure of, by the cryoscopic method, ii, 7.
—— —— presence of saccharifying enzymes in, ii, 53.
—— stains, medico-legal detection of, ii, 376.
—— sugar in, after bleeding, ii, 24.
Bocconia frutescens, alkaloïds of, i, 689.
Bocconine, i, 689.
Boiling point apparatus for the determination of molecular weight, ii, 479, 480.
—— —— melting point and solubility, change of, ii, 107.
—— points, determination of, by the dynamical method, ii, 379.
—— —— law of corresponding, ii, 37, 70, 154.
Boleite, ii, 115.
Bone-black, analysis of, ii, 416.
Bones of a mummy, analysis of, ii, 456.
—— of wild and tame rabbits, ii, 519.
Borates, lowering of the freezing point by, ii, 156.
Borax as a standard alkali, ii, 368.
Boric acid, action of thionyl chloride on, ii, 43.
Borneol, combination of, with aluminium chloride, i, 60.
—— from *d*-eucalyptene, i, 674.
Boron diethoxyfluoride, i, 452.
—— dimethoxyfluoride, i, 452.
—— displacement of carbon from fused cast iron by, ii, 220, 270.
—— estimation of, in organic fluorine compounds, i, 453.
—— ethoxydifluoride, i, 452.
—— fluoride, action of, on organic compounds, i, 451.
—— methoxydifluoride, i, 452.
—— steel, ii, 269.
Boxwood, action of nitric acid on, i, 323.
Brain, blood gases of the, in rest and activity, ii, 231.
—— calcareous concretions in the, ii, 53.
—— exchange of blood gases in the, ii, 231, 405.
"Brazilite," ii, 505.
"Brilliant-green," action of bromine on, i, 56.
"Brilliant-yellow," constitution of derivatives of, i, 135.
Bromal hydrate, thermal behaviour of, on solidification, ii, 378.
Bromine, atomic refraction of, ii, 430.
—— chlorine and iodine, estimation of, in their admixed silver salts, ii, 459.
—— estimation of, in organic compounds, ii, 326.
—— estimation of, in presence of chlorine, ii, 289.
—— rate of escape of, from aqueous solutions of varying concentration, TRANS., 874, 879.
—— solubility of, in carbon bisulphide at low temperatures, ii, 489.
Brown-coal tar, i, 258.
—— —— —— quinoline bases in, i, 244.
Brucine, compound of, with 1 : 3 : 5-trinitrobenzene, i, 653.
—— hydropolysulphide, i, 403.
Burner for monochromatic (sodium) light, ii, 345.
Butanetetracarboxylamide, i, 335.
Butanetetracarboxylimide, i, 336.
Butanetetracarboxyldiphenylimide, i, 336.
Butanetetracarboxylic acid, diamic acid of, i, 336.
—— —— dianilic acid of, i, 336.
—— acids, i, 335.
Butanetetracarboxylphenylhydrazide, i, 336.
Butinenecarboxylic acid, i, 510.
Butter, detection of margarine in, ii, 145.
—— effect on, of feeding with sesame and cotton cakes, ii, 299.
—— estimation of fatty acids soluble in water containing sulphuric acid, ii, 539.
—— modification of the Reichert-Meissl method of analysis of, ii, 95.
—— of southern and mid-Sweden, "baryta number" of, ii, 374.
—— testing, for foreign fats, ii, 145.
—— volatile fatty acids in, periodic estimation during a year of the, ii, 95.
iso-Butylacetic acid, affinity constant of, ii, 253.
iso-Butylallylcarbinol, i, 198.
iso-Butylallylcarbinylic acetate, i, 198.
iso-Butylamyl, rotatory power of, ii, 97.
iso-Butylanhydrodibenzilacetoacetic acid, PROC., 1895, 147.
Butylbenzene, amido-, i, 633.
—— nitro-, i, 633.
iso-Butylbenzene, amido-, i, 633.
—— nitro-, i, 633.
iso-Butylcarbamide, TRANS., 559.
sec-Butylcarbamide, TRANS., 560.
iso-Butylcitraconic acid, i, 207.
—— anhydride, i, 207.

iso-Butylenediphenyldisulphone, i, 286.
ψ-Butylenediphenyldisulphone, i, 286.
iso-Butyleneglycollic nitrite, i, 23.
Butylenic dibromide, bromo-, i, 16.
Butylic acetylhydroxybutyrate, rotatory power of, ii, 471.
—— acetylmalate, rotatory power of, ii, 251.
—— alcohol, heat of vaporisation of, ii, 101.
—— diacetyltartrate, i, 174.
—— dipropionyltartrate, i, 174.
—— divaleryltartrate, i, 174.
—— *l*-ethoxysuccinate, Trans., 973.
—— *α*-hydroxybutyrate, physical properties of, i, 410.
—— malate, rotatory power of, ii, 251.
—— *l*-methoxysuccinate, Trans., 971.
—— tartrate, i, 174.
iso-Butylic acetylhydroxybutyrate, rotatory power of, ii, 371, 472.
—— acidyltartrates, rotatory power of, ii, 195.
—— alcohol, heat of vaporisation of, ii, 101.
—— amylic ether, b. p., sp. gr., and rotatory power of, i, 318.
—— *α*-bromobutyrate, rotatory power of, ii, 472.
—— butyrylhydroxybutyrate, rotatory power of, ii, 472.
—— campholate, i, 295.
—— caproylhydroxybutyrate, rotatory power of, ii, 472.
—— *α*-chlorobutyrate, rotatory power of, ii, 472.
—— cyanacetoacetate, i, 649.
—— diacetyltartrate, i, 211.
—— dibenzoyltartrate, i, 268.
—— dibutyryltartrate, i, 211.
—— di-*iso*-butyryltartrate, i, 211.
—— dicaproyltartrate, i, 211.
—— dipropionyltartrate, i, 211.
—— divaleryltartrate, i, 211.
—— di-*iso*-valeryltartrate, i, 211.
—— *d*-ethoxysuccinate, Trans., 974.
—— *l*-ethoxysuccinate, Trans., 974.
—— *α*-hydroxybutyrate, physical properties of, i, 410.
—— nitro-*iso*-butyrate, rotatory power of, ii, 472.
—— nonanoylhydroxybutyrate, rotatory power of, ii, 472.
—— *d*-phenylbromacetate, i, 451.
—— propionylhydroxybutyrate, rotatory power of, ii, 472.
—— valerylhydroxybutyrate, rotatory power of, ii, 472.
sec-Butylic alcohol, nitro-, i, 638.
—— bromide, Trans., 265.
iso-Butylideneacetone, i, 643.
iso-Butylidenephenylhydrazine, i, 475.
iso-Butylideneacetoxime, i, 643.
Butylnitramine, i, 589.
iso-Butylnitramine, i, 589.
sec-Butylnitramine, i, 589.
p-*iso*-Butylphenol, bromo- and dibromo-, i, 273.
ab-*sec*-Butylphenylcarbamide, Trans., 561.
ab-*sec*-Butylphenylurea, Trans., 561.
p-*iso*-Butylsalicylaldehyde and its derivatives, i, 222.
—— *o*-bromo-, i, 222.
p-*iso*-Butylsalicylaldoxime, i, 222.
—— *o*-bromo, i, 223.
p-*iso*-Butylsalicylonitrile, i, 222.
sec-Butylthiourea, Trans., 559.
iso-Butyltripiperidine-*n*-phosphonium iodide, i, 683.
Butylurea, Trans., 560.
iso-Butylurea, Trans., 559.
Butyramide, heat of formation of, ii, 483.
iso-Butyramide, heat of formation of, ii, 483.
Butyranilide, heat of formation of, ii, 483.
Butyric acid, affinity constant of, ii, 253.
—— anhydride, *α*-bromo-, i, 17.
—— chloride, reduction of, Proc., **1895**, 216.
iso-Butyric acid, affinity constant of, ii, 253.
—— anhydride, *α*-bromo-, i, 17.
Butyronitrile, physiological action of, ii, 238.
iso-Butyro-*m*-toluidide, i, 572.
Butyrylbutyric acid, i, 479.
Butyrylphenylhydrazine, i, 649.
iso-Butyrylphenylhydrazine, i, 649.

C.

Cactus alkaloïds, i, 120.
Cadaverine from putrid horseflesh, i, 196.
Cadmiferous blende from Mies, Bohemia, ii, 505.
Cadmium, action of nitrous acid on, ii, 312.
—— action of, on moist nitrous oxide, ii, 495.
—— arsenite, ii, 218.
—— diammonium chloride, ii, 11.
—— dichromate mercury cyanide, ii, 356.
—— isomorphism of, with metals of the zinc series, ii, 309.
—— *d*-lactate, Trans., 626.
—— potassium dichromate, ii, 355.

Cadmium salicylate, i, 281.
—— salts, refractive indices of aqueous solutions of, ii, 33.
—— separation of arsenic, antimony, or tin from, ii, 89.
—— separation of bismuth from, ii, 331.
—— separation of copper from, ii, 246, 371.
—— separation of lead from, ii, 332.
—— separation of mercury from, ii, 532.
—— thiohypophosphates, ii, 389.
—— titration of, with sodium sulphide, ii, 64.
Cæsium bromide, heat of formation of, ii, 265.
—— cobalt bromides, ii, 166.
—— —— chlorides, ii, 166.
—— —— iodide, ii, 166.
—— dinitrosoferrothiosulphonate, ii, 451.
—— ferric bromides, ii, 165.
—— —— chlorides, ii, 165.
—— heptanitrosoferrothiosulphonate, ii, 451.
—— iodide, heat of formation of, ii, 264.
—— —— m.p. of, ii, 36.
—— —— molecular volume of, ii, 264.
—— nickel bromide, ii, 166.
—— —— chloride, ii, 166.
—— oxide, action of hydrogen on, ii, 265.
—— preparation and sp. gr. of, ii, 389.
—— sulphate, mol. refraction of dissolved, Trans., 838.
—— thallium bromides, ii, 398, 399.
—— —— chlorides, ii, 398, 399.
—— —— iodide, ii, 399.
Caffearine, i, 629.
Caffeïne, chloro-, action of metallic cyanides on, i, 628.
—— —— physiological action of, ii, 238.
—— derivatives of, i, 116.
Caffeïnecarboxylamide, i, 628.
Caffeïnecarboxylic acid, i, 629.
Caffeylmethylamine, i, 629.
Calcium arsenites, ii, 218.
—— bromide, alcoholate of, ii, 390.
—— carbide, action of absolute alcohol on, i, 259.
—— —— heat of formation of, ii, 341.
—— —— properties of, ii, 265.
—— carbonate, estimation of, in soils, ii, 245.
—— chloride, m.p. of, ii, 36, 339.
—— —— mol. refraction of dissolved, Trans., 836, 844, 864.
—— —— solutions, freezing points, heat of dissolution, and densities of, ii, 208.
Calcium chloride solutions, volumes of, between 100° and 150°, ii, 307.
—— citrate, presence of, in plants, ii, 27.
—— cupriferrocyanide, i, 407.
—— cuproferrocyanide, i, 407.
—— effect of, on the development of the organised structures of the cell, ii, 457.
—— estimation, volumetric of, ii, 327.
—— ethoxide, i, 259.
—— *l*-lactate, Trans., 626.
—— oxide, action of dry hydrogen chloride on, Proc., **1894**, 240.
—— —— assimilation of, in the body during disease, ii, 120.
—— —— compound of, with alcohol, ii, 341.
—— —— estimation of, in quicklime, ii, 186.
—— oxybromide, formation and thermochemistry of, ii, 45.
—— —— thermal constants of, ii, 304.
—— oxyiodide, thermochemistry of, ii, 45, 304.
—— phosphate and carbonate, effect of, on live weight, ii, 173.
—— —— effect of the addition of, to food, ii, 121.
—— —— in milk, ii, 122.
—— —— removal of the phosphoric acid from, as alkali phosphate, ii, 112.
—— plumbates, ii, 14.
—— rottlerin, Trans., 235.
—— salts, action of, on the animal organism, ii, 53.
—— —— action of, on the herbage of meadows, ii, 458.
—— separation, qualitative of, barium and strontium from, ii, 461.
—— silicate, heat of formation of, ii, 306.
—— specific ionic velocity of, ii, 477.
—— sulphate, anhydrous, solubility of, ii, 350.
—— tartrarsenite, Trans., 105.
—— triphosphate, ii, 446.
Calculi, uric acid, piperazine as a solvent for, in urine, ii, 56.
Calibration of measuring vessels, apparatus for, ii, 368.
Callopisma vitellinum, ethylic vulpate and calycin in, i, 298.
Calomel electrode (cell), ii, 377.
Calorimetric behaviour of saline solutions, ii, 255.
Calycium chlorinum, vulpic acid from, i, 298.
Calycium Stenhammari, calycin from, i, 298.
Camphane series, action of nitrous acid on the oximes of, i, 426.

Camphene, constitution of, i, 428, 675.
—— α-dichloro-, Proc., **1895**, 57.
Camphenesulphonamide, α-chloro-, Proc., **1895**, 57.
—— β-chloro-, Proc., **1895**, 58.
Camphenesulphonic chloride, α-chloro-, Proc., **1895**, 57.
—— —— β-chloro-, Proc., **1895**, 57.
Camphenone, i, 61, 382.
—— bromo-, i, 382.
Camphenoxime, action of nitrous acid on, i, 426.
—— action of phosphorus pentachloride on, i, 382.
Camphenylnitramine, i, 426.
Camphocarboxylic acid, action of phenylic isocyanate on, i, 679.
iso-Campholactone, i, 296.
α-Campholenamide, i, 676.
Campholenamides, i, 241, 552.
Campholene, i, 140, 240.
—— derivatives, i, 675.
iso-Campholene, i, 240.
Campholenes, i, 240.
Campholenic acid, action of heat on, i, 240, 624.
—— —— constitution of, i, 240.
—— —— heat of formation of, ii, 436.
—— —— nitroso-, constitution of, i, 677.
—— acids, i, 241, 552.
—— —— heat of dissolution and neutralisation of, ii, 484.
—— derivatives, i, 623.
—— lactone, heat of formation of, ii, 484.
α-Campholenic acid, i, 676.
—— —— constitution of, i, 428, 675.
β-Campholenic acid, i, 676.
—— —— constitution of, i, 428, 675.
β-Campholenonitrile, preparation of, i, 427.
Campholic acid, action of phenylic isocyanate on, i, 679.
—— —— constitution of, i, 428, 675.
—— —— ethereal salts of, i, 295.
—— —— heat of formation of, ii, 436.
—— —— metallic salts of, i, 295.
—— —— preparation of, i, 241.
—— —— reduction of, i, 241.
—— anhydride, i, 383.
—— anilide, i, 383.
—— cyanide, i, 383.
—— phenylhydrazide, i, 383.
iso-Campholic acid, i, 61.
iso Campholimide, i, 62.
Campholytic acid, dibromide, i, 187.
allo-Campholytic acid, Trans., 341.
—— —— dibromide, Trans., 343.
cis-Campholytic acid, i, 295.
cistrans-Campholytic acid, derivatives of, i, 296.
iso-Campholytic acid, i, 295.
—— —— identity of camphothetic acid with, Trans., 347.
Camphor, i, 426.
—— amido-, action of nitrous acid on, i, 61, 382.
—— *iso*-amido-, i, 427.
—— —— constitution of, i, 428, 675.
—— π-bromo-, dextrorotatory, Trans., 382.
—— —— racemic, Trans., 387.
—— bromonitro-, Proc., **1895**, 34.
—— chloro-, combination of, with aluminium chloride, i, 60.
—— π-chloro-, dextrorotatory, Trans., 377.
—— —— inactive, Trans., 378.
—— chlorobromo-, action of nitric acid on, Proc., **1895**, 6.
—— απ-chlorobromo-, Trans., 393.
—— πα-chlorobromo-, Trans., 397.
—— combination of, with aluminium chloride, i, 60.
—— constitution of, i, 240, 428, 675.
—— conversion of, into an isomeric unsaturated compound, i, 426.
—— α-dibromo-, action of nitric acid on, Proc., **1895**, 5.
—— —— derivatives of, Proc., **1895**, 4.
—— απ-dibromo-, Trans., 391.
—— απ-dichloro-, Trans., 389.
—— π-halogen derivatives of, Trans., 371.
—— isomeric sulphonic chlorides derived from, Proc., **1895**, 57.
—— nitro-, i, 60.
—— *iso*-nitroso-, i, 623.
—— —— anhydride of, i, 623.
—— series, action of nitrous acid on the oximes of, i, 426.
—— —— bromine derivatives of the, i, 382.
—— sulphonic derivatives of, Trans., 354.
Camphor from *d*-eucalyptene, i, 674.
Camphoraldehyde, i, 62.
Camphoranic acid, i, 243.
d-Camphor-*p*-bromophenylhydrazone, i, 675.
Camphoric acid, i, 187, 295.
—— —— π-bromo-, derivatives of, Proc., **1895**, 88.
—— —— —— from the oxidation of π-di-bromocamphor, Proc., **1895**, 33.
—— —— constitution of, Trans., 345; i, 188, 428, 552, 675.
—— —— oxidation of, i, 678.
—— —— oxidation products of, i, 552.
Camphoric amide, action of potassium hypobromite on, i, 383.
Camphoric anhydride, action of, on

benzene in presence of aluminium chloride, i, 108.
Camphoric anhydride, action of hydroxylamine on, i, 382.
—— —— bromo-, i, 154.
—— —— —— preparation of, i, 154.
—— —— π-bromo-, Proc., **1895**, 34.
Camphoric dianilide, i, 296.
Camphorimidazolone, i, 400.
Camphorimine, i, 426.
—— nitrate, i, 426.
Camphoronic acid, i, 242.
—— —— and its optical isomerides, i, 188.
—— —— constitution of, i, 679.
—— chloride, acid formed by the action of bromine on, i, 188.
i-Camphoronic acid, barium and calcium salts of, i, 188, 242.
Camphoroxime, i, 427, 624.
—— action of nitrous acid on, i, 426.
d-Camphorsemicarbazone, i, 675.
Camphorsulphonic bromide, bromo-, Trans., 367.
—— —— chloro-, Trans., 369.
—— —— dextrorotatory, preparation of, Trans., 364.
—— —— optically inactive, preparation of, Trans., 359.
—— chloride, dextrorotatory, preparation of, Trans., 358.
—— —— optically inactive, preparation of, Trans., 357.
—— chlorides, chloro- and bromo-, preparation of, Trans., 356.
Camphorylhydroxamic acid, i, 383.
Camphorylhydroxylamine, i, 382.
Camphothetic acid, i, 295.
—— —— identity of with *iso*-campholytic acid, Trans., 347.
Camphylic acid, bromo-, Proc., **1895**, 24.
—— —— sulpho-, i, 154.
—— —— sulphochloride, Proc., **1895**, 24.
Cananga, essence of, i, 425, 551.
Cancer, the blood in, ii, 280.
Candelaria concolor, calycin from, i, 298.
"Cannabene," i, 623.
Cannabis indica, alkaloïds of, i, 631.
—— —— essence of, i, 623.
Cannabis sativa, alkaloïds of, i, 631.
Capillarity, changes of, with temperature, ii, 40.
Capric acid, affinity constant of, ii, 253.
Caproic acid, β-bromo-, i, 206.
—— —— αβ-dibromo-, i, 206.
Capronitrile, physiological action of, ii, 238.
Caprylic acid, affinity constant of, ii, 253.
—— —— amido-, i, 82.
Carbamide acetate, i, 270.
Carbamide, action of nitrosyl chloride on, Trans., 490.
—— amidoacetate, i, 270.
—— conversion of, into cyanamide, i, 411.
—— glycollate, i, 270.
—— hydrogen malonate, i, 270.
—— substitution derivatives of, Trans., 556.
—— transformation of ammonium cyanate into, Trans., 746.
—— See also Urea.
Carbamidoazo-*iso*-butyramide, i, 252.
Carbamidoazo-*iso*-butyronitrile, i, 252.
Carbamidohydrazo-*iso*-butyramide, i, 252.
Carbamidohydrazo-*iso*-butyronitrile, i, 252.
Carbaminazoimide, i, 252.
Carbazole, a colour reaction of, i, 422.
Carbodiphenylimide, action of sodium ethoxide on, i, 277.
—— dihydrochloride, i, 277.
Carbodiphenylimides, space isomerism of, i, 42.
Carboditolylamides, space isomerism of, i, 42.
Carbohydrates and fat, relation of, to the decomposition of albumin in the human body, ii, 505.
—— effect of on the production of sugar in the urine, ii, 406.
—— estimation of, ii, 94.
—— from fungi, i, 323.
—— metabolism of, and the liver, ii, 360.
—— of normal urine, ii, 82.
—— of the gum of *Acacia decurrens*, ii, 285.
—— of yeast, i, 166.
—— prepared from formaldehyde, i, 444.
—— sparing influence of, on proteïds, ii, 78.
Carbohydrazimide, i, 30.
Carbon, alleged separation of in the cyanogen flame, Trans., 1061.
—— and its compounds, action of aluminium on, ii, 167.
—— and sulphur, combination of nitrogen with, ii, 495.
—— atomic refraction of, ii, 42, 430.
—— atoms, asymmetric, in the same molecule, superposition of the optical effects of, ii, 149, 195.
—— bisulphide, action of argon on, ii, 498.
—— —— action of heat on, ii, 312.
—— —— action of nitrogen on, ii, 495.
—— —— magnetic rotation of, ii, 474.
—— —— solubility of substances in, at low temperatures, ii, 489.
—— bivalent, in isocyanides, i, 9.

Carbon, displacement of, from fused cast iron by boron and silicon, ii, 220, 270.
—— electrodes, variations observed in the spectra of, ii, 432.
—— estimation, colorimeters for, ii, 416.
—— estimation of, in iron, ii, 330, 531.
—— estimation of, in steel, ii, 86, 292.
—— monosulphide, ii, 222.
—— sesquisulphide, ii, 313.
—— tetrabromide, i, 123.
—— tetrachloride, i, 123.
—— tetriodide, i, 123.
—— volatilisation of, ii, 164.
Carbonates and caustic alkalis in mixtures, estimation of, ii, 63, 64.
Carbonic acid, imido-derivatives of, i, 277.
Carbonic anhydride, absorption coefficient of, in water at the freezing point, ii, 104.
—— —— apparatus for the estimation of, ii, 31.
—— —— electrical conductivity of aqueous solutions of, ii, 100.
—— —— estimation, gravimetric, of, ii, 460.
—— —— estimation of, in the air, ii, 32.
—— —— exchanges of plants, ii, 520.
—— —— hydrate of, ii, 44.
—— —— in the critical state, ii, 71.
—— —— influence of, on the coagulation of blood, ii, 78.
—— —— liquefied, analysis of, ii, 532.
—— —— rate of escape of, from aqueous solutions of varying concentration, Trans., 874, 879.
—— —— reduction of, at the ordinary temperature, ii, 348.
—— —— solid, ii, 497.
—— —— —— low temperatures attainable with, ii, 498.
—— —— —— temperature of, under atmospheric pressure, ii, 498.
—— —— specific heat of, at constant volume, ii, 69.
—— —— temperature and the output of, ii, 452.
—— —— vegetable principles which decompose with evolution of, ii, 124.
Carbonic oxide, elimination of, from ketonic compounds, i, 329.
—— —— nitrogen oxides formed during the combustion of, in air, ii, 62.
—— —— physiological action of, ii, 407.
Carbonyl bromide, i, 317.
—— chloride, action of, on derivatives of sulphonic and sulphinic acids, i, 287.
—— chlorobromide, i, 317.
Carbonyl nitride, i, 12.
Carbonyldicarbamide, behaviour of, in the animal organism, ii, 280.
Carbophenylimide, isomeric modifications of, i, 415.
Carboxyanilidoacetic acid, i, 145.
Carboxyethyl-*o*-amido-*p*-toluamide, i, 524.
Carminic acid, i, 67.
—— —— anilide of, i, 68.
Carnic acid, i, 76.
Carniferrin, i, 76.
Carone, constitution of, i, 152, 549, 551.
—— dinitrin, i, 380.
—— dinitrosone, i, 380.
d-Carone, bisnitroso-, i, 379.
—— sp. gr. and rotatory power of, i, 379.
i-Carone, bisnitroso-, i, 379.
—— semicarbazide, i, 379.
l-Carone, properties of, i, 379.
Caronedinitrosylic acid, i, 380.
Caroneoxime, i, 152.
Carvacrol, amido-, i, 546.
—— —— methyl ether, i, 546.
—— bromo-, i, 547.
—— —— methyl ether, i, 547.
Carvenone, i, 622.
—— oxime and semicarbazones of, i, 672.
—— physical properties of, i, 673.
Carveol methyl ether, i, 59.
—— nitroso-, i, 380.
Carvestrene, i, 153.
—— dihydrobromide and dihydrochloride, i, 152.
Carvone, constitution of, i, 675.
—— pentabromides, i, 622.
—— series, brominated derivatives of, i, 621.
—— tetrabromides, crystallography of, i, 622,
—— tribromide, i, 621.
—— —— racemic, action of ammonia on, i, 622.
—— tribromides, crystallography of, i, 622.
i-Carvone dibromide, crystallography of, i, 622.
Carvotanacetone, i, 620.
—— oxime and semicarbazones of, i, 672.
—— physical properties of, i, 673.
Carylamine, i, 152.
Caseïn, behaviour of, in ammoniacal magnesium chloride solution, i, 692.
—— behaviour of the phosphorus of, in peptic digestion, ii, 54, 119.
—— of human milk, ii, 54.
Caseïnogen, action of rennet and related ferments on, ii, 80.

Cassia, oil of, *o*-coumaraldehyde methyl ether from, i, 279.
Cassiterite, ii, 275.
Castor oil, analysis of, ii, 147.
—— —— detection of, in copaiba balsam and croton oil, ii, 147.
Catechol, action of chlorine on, i, 131.
—— action of phthalic chloride on, i, 219.
—— condensation of glyoxylic acid with, i, 171.
—— dibromo-, i, 456.
—— halogen derivatives of, i, 456.
—— phosphite, i, 23.
—— sulphite, i, 23.
—— trichloro-, i, 456.
Cathode, discharge, action of, on some salts, ii, 150.
Cathodes, polarisation with solid and with liquid, ii, 67.
Celestite from Giershagen, Westphalia, ii, 505.
Cell, effect of calcium and magnesium on the development of the organised structures of, the, ii, 457.
Cell-membrane of fungi, ii, 323.
—— —— of fungi, and chitin, i, 80, 166, 323.
—— —— of fungi, presence of chitin in, ii, 408.
Cell. See also battery, galvanic cell.
Cells, animal and vegetable, distribution of assimilated iron compounds other than hæmoglobin and hæmatins in, ii, 518.
—— containing chromophyll, the separation of oxygen by, ii, 26.
Cellulose, acetylation of, Trans., 447.
—— action of fused potash on, i, 167.
—— chemistry of, Trans., 433.
—— electrochemical phenomena of, Trans., 436, 449.
—— fungus-, nitrogenous compound from, i, 80.
—— —— products of the hydrolysis of, i, 199.
—— hydrolysis and hydration of, Trans., 441.
—— nitro-, estimation of nitrogen in, ii, 243.
—— —— researches on explosives containing, ii, 434.
—— oxidation of, i, 587.
—— sulphuric acid and the products of its hydrolysis, Trans., 74.
—— tetracetate, Trans., 448.
a-Cellulose, i, 166.
b-Cellulose, i, 166.
Celluloses, classification of, Trans., 439.
—— distillation of, with sulphuric acid, i, 640.
Centrifugal apparatus, ii, 216.
—— force, action of, on chemical systems, ii, 490.
Cerite earths, ii, 352, 393, 448.
—— metals, ii, 352, 393, 448.
—— oxides, ii, 449.
Cerium, atomic weight of, ii, 352, 353, 393.
—— compounds, ii, 15.
—— estimation, volumetric, of, ii, 353.
—— qualitative tests for, ii, 15.
—— resolution of, ii, 352, 353, 393.
—— separation of, from other metals of the same group, ii, 15.
—— sulphate, ii, 352, 393.
—— trichloride, heptahydrate of, ii, 15.
Cerium-yttrium group, not yet thoroughly characterised, elements of, Trans., 477.
—— —— perfectly characterised elements of, Trans., 475.
Cerous hydroxide, colour of, ii, 16.
Cetraria juniperina var. pinastri, acid from, i, 299.
Cetraria pinastri, pigment of, i, 297.
Cetylic nitrite, i, 23.
Charcoal, action of sulphuric acid on, i, 229.
—— ammonia and nitrogen oxides formed during the combustion of, in air, ii, 62.
—— wood, gases from, at a high temperature, ii, 109.
Chay root, colouring and other principles contained in, Trans., 817.
Cheese, analysis of, ii, 539.
—— making, application of gas analysis to, ii, 148.
—— vegetable, ii, 130.
Chelerythrine, i, 689.
Chelidamic acid, Trans., 403.
Chelidonine, reactions for with phenols, ii, 336.
Chemical action, influence of magnetism on, ii, 152.
—— affinity, nature of, Trans., 1124.
—— change and electrolytic change, unity of, Trans., 1139.
—— —— and the conditions which determine it, nature of, Trans., 1122.
—— —— effect of "impurity" in conditioning, Trans., 1139.
—— —— electromotive efficiency in, Trans., 1147.
—— —— influence of moisture on, Trans., 1139.
—— constitution and latent heat of fusion, relationships between, Trans., 315.
—— equilibria as temperature functions, ii, 211.

Chemical systems, influence of centrifugal force on, ii, 490.
Chemometer, ii, 108.
Cherts of Missouri, ii, 118.
Chick, heat production in the, after and before hatching, ii, 51.
Chitin, i, 166.
—— action of fused potash on, i, 167.
—— and the cell membrane of fungi, i, 80, 166, 223; ii, 408.
Chitosan, i, 167, 444.
Chloral nitrite, i, 23.
Chloranil, action of hydrazine hydrate on, i, 27.
Chloranilic acid, m. p. of, ii, 379.
Chlorate, detection and estimation of, in bleaching powder, ii, 527.
Chlorides, effect of, on vegetation and on the amount of starch in potatoes, ii, 61.
Chlorine, atomic refraction of, ii, 430.
—— bromine and iodine, estimation of, in the admixed silver salts, ii, 459.
—— detection and estimation of, in presence of iodine, ii, 242.
—— detection of, in methylene blue, ii, 182.
—— estimation of bromine in presence of, ii, 289.
—— estimation of, in commercial iodine, ii, 136.
—— estimation of, in organic compounds, ii, 182, 326.
—— estimation of, in organic compounds, with hydrogen peroxide, ii, 244.
—— estimation of, in urine, ii, 62.
—— estimation of, in wool grease, ii, 326.
—— estimation of small quantities of, in fats, ii, 85.
—— rate of escape of, from aqueous solutions of varying concentration, Trans., 874, 879.
—— specific ionic velocity of, ii, 477.
Chloroform, electrolysis of the vapour of, ii, 476.
Chlorophyll, i, 296, 624.
—— from spinach, i, 389.
—— protective action of the cyanic colouring matters on, ii, 27.
Chlorophylls, i, 389.
—— from lucerne, i, 389.
—— presence of several distinct, in the same vegetable species, i, 66.
Cholic acid, blue iodide of, i, 313, 322.
Choline, alleged, ready conversion of, into neurine, i, 200.
—— from putrid horseflesh, i, 196.
—— occurrence of, in seeds of plants, ii, 364.
Chondroitin-sulphuric acid, i, 254.
Chrome ore, estimation of chromium in, ii, 294.
Chromic anhydride, volatility of, ii, 396.
Chromite in Lower Silesia, ii, 50.
Chromium chloride, green, $CrCl_3,6H_2O$, ii, 229.
—— estimation of, in chrome ore, ii, 294.
—— formate, i, 15.
—— hydroxide, molecular changes in, ii, 501.
—— separation, qualitative, of iron and aluminium from, ii, 88.
—— titration of, with sodium sulphide, ii, 64.
Chromium-bases, constitution of, ii, 47.
Chromium-zinc alloy, ii, 351.
Chromophyll, the separation of oxygen by cells containing, ii, 26.
Chrysanthemine, i, 631.
Chrysocetraric acid, i, 299.
Chrysophanic acid, i, 292.
Chrysophanohydroanthranone, i, 292.
Chrysophenin, constitution of, i, 135.
Cicuta virosa, poisonous constituents of, i, 680.
Cicutoxin, i, 681.
Cinchona alkaloïds, constitution of the additive compounds of, with ethylic iodide, i, 75.
Cinchonic acid ethochloride, i, 76.
Cinchonicine, i, 688.
—— ethiodide, i, 689.
—— ethobromide, i, 689.
—— methiodide, i, 689.
—— methochloride, i, 689.
—— zinc chloride, i, 689.
Cinchonigine, i, 404.
Cinchonine, constitution of, i, 434, 483.
—— ethiodide, constitution of, i, 76.
—— hydrochloro-, i, 630.
—— oxidation of, i, 483.
—— reduction of, i, 579, 630, *631*, *688*.
—— trihydriodo-, action of water on, i, 76.
Cinchotenine, i, 254, 483.
—— derivatives of, i, 403.
—— ethiodides of, i, 403.
—— ethylic salt of, i, 483.
—— oxidation of, i, 484.
—— phenylhydrazones of, i, 435.
Cinchotine, action of hydriodic acid on, i, 403.
Cinchotoxine, i, 434.
—— nitroso-, i, 435.
—— phenylhydrazone, i, 435.
Cinnamaldehyde, freezing point of, i, 272; ii, 207.
anti-Cinnamaldoxime, i, 138.
Cinnamamide, dibromo-, i, 365.
Cinnamene, action of nitrous acid on, i, 456.

Cinnamene, action of sulphur on, i, 338, 510.
Cinnamic acid, 3 : 6-bromonitro-, i, 282.
—— —— derivatives, i, 364.
—— —— isomeric dichloride of, i, 663.
—— —— polymerisation of, i, 279.
—— acids, bromo-, constitution of the, i, 223.
Cinnamoylanisoïl, condensations with, i, 49.
Cinnamoyl-*p*-iodoaniline, i, 365.
ab-Cinnamoyl-α-naphthylthiocarbamide, Trans., 1048.
Cinnamoylphenylcarbamide, Trans., 1047.
ab-Cinnamoylphenylthiocarbamide, Trans., 1046.
Cinnamoylthiocarbimide, derivatives of, Trans., 1046.
Cinnamoylthiourea, Trans., 1048.
Cinnamoyl-β-thiourethane, Trans., 1049.
Cinnamoyl-*o*-toluidine, i, 365.
Cinnamoyl-*p*-toluidine, i, 365.
Cinnamoyltoluresinotannol, i, 189.
ab-Cinnamoyl-*o*-tolylthiocarbamide, Trans., 1047.
ab-Cinnamoyl-*p*-tolylthiocarbamide, Trans., 1047.
Cinnamoyltrimethyldihydroquinoline, i, 392.
Cinnamoyl-*m*-xylidine, i, 365.
Cinnamoyl-*p*-xylidine, i, 365.
allo-Cinnamylideneacetic acid, i, 470.
—— —— molecular change in, on exposure to sunlight, i, 454.
Cinnamylideneacetophenone, i, 563.
Cinnamylideneacetophenoneoxime, i, 563.
Cinnamylideneacetoxime, i, 562.
Cinnamylidenebenzoylhydrazine, i, 35.
Cinnamylidene-2 : 4-dinitrophenylhydrazine, i, 28.
Cinnamylidenemalonic acid, i, 470.
Cinnamylidenemalonylhydrazine, i, 264.
Cinnamylideneoxalylhydrazine, i, 264.
Cinnamylidenepicrylhydrazine, i, 28.
Cinnamylidenesuccinylhydrazine, i, 264.
Citrazinimide, i, 157.
Citric acid, action of antimonious oxide on the salts of Trans., 1030.
—— —— action of arsenious anhydride on the salts of, Trans., 1033.
—— —— in milk, ii, 122.
Citronellal, occurrence of, in lemon oil, i, 382.
Citrus aurantium Chinensis, levulose from the dried peel of, ii, 129.
Cladonia coccifera, coccellic acid from, i, 299.
Clark cell, E.M.F. of, ii, 475.
Clark cell, E.M.F. of, when producing a current, ii, 34.
Claviceps purpurea, cell membrane of, ii, 323.
Clèvite, discovery of helium in, Trans., 1107.
—— helium in, ii, 347.
—— spectrum of the gas from, Trans., 1108; ii, 431.
Clinoclase, ii, 507.
Clostridium Pasteurianum, ii, 284.
Coagulation and synthesised colloïds, i, 484; ii, 454.
—— of arsenious solutions, Trans., 63.
—— of blood, ii, 52.
—— of fibrinogen, ii, 235.
—— of milk, ii, 122.
—— of proteïds by mechanical means, i, 254.
Coal, action of water on, ii, 264.
—— estimation of phosphorus in, ii, 328.
Coal-gas, ammonia and nitrogen oxides formed during the combustion of, in air, ii, 62.
—— —— estimation of sulphurous and sulphuric anhydrides in the products of combustion of, ii, 368.
—— —— flame, chemistry and structure of, Trans., 1049; ii, 478.
—— —— —— structure and chemistry of the non-luminous, Trans., 1051; Proc., **1895**, 72.
Coal-tar, bases from, i, 390.
Cobalt, action of nitrous oxide on, ii, 312.
—— action of, on fused ammonium salts, Proc., **1895**, 114.
—— ammonium dichromate, ii, 355.
—— arsenites, ii, 218.
—— atomic weight of, ii, 167, 318.
—— cæsium bromides, ii, 166.
—— —— chlorides, ii, 166.
—— —— iodide, ii, 166.
—— chloride and manganese chloride, mixed crystals of, ii, 209.
—— —— molecular refraction of dissolved, Trans., 836, 844.
—— dichromate mercury cyanide, ii, 356.
—— estimation, colorimetric, of, in its ores, ii, 534.
—— oxidising action of ammonia solution on, Proc., **1895**, 9.
—— separation of arsenic, antimony, or tin from, ii, 89.
—— separation of bismuth from, ii, 422, 423.
—— separation, electrolytic, of zinc from, ii, 89.
—— separation (qualitative) of nickel from, ii, 247.

Cobalt, sodium triphosphate, ii, 446.
—— specific ionic velocity of, ii, 477.
—— sulphide, behaviour of, with alkali sulphides, ii, 355.
—— —— formation of, in solution, ii, 228.
—— sulphide, properties of, at the moment of its formation, ii, 228.
—— titration of, with sodium sulphide, ii, 64.
Cobalt-bases, constitution of, ii, 47.
Cobaltous chloride, compounds of, with metallic bases, ii, 121, 122.
Coca leaves from Java, volatile principles of, ii, 365.
Cocaine, decomposition of, in the animal body, ii, 336.
—— detection of, in the animal body, ii, 336.
—— technical preparation of, from its associated alkaloïds, i, 76.
Coccellic acid, i, 299.
Cocoa, estimation of theobromine in, ii, 542.
—— nutritive value of, ii, 61.
Cœrulein, condensation of, with aniline, i, 424.
—— constitution of, i, 424.
Coffee, new alkaloïd contained in, i, 629.
—— production of pyridine, in the roasting of, i, 624.
Coke, ammonia and nitrogen oxides formed during the combustion of, in air, ii, 62.
—— estimation of phosphorus in, ii, 328.
Colchicine, detection of, ii, 300.
Collidine, a new, i, 390.
Colloïds, coagulation of, i, 324.
—— Grimaux's, i, 314.
—— synthesised and coagulation, i, 484, ii, 454.
—— —— physiological action of, ii, 454.
Colostrum of the cow, ii, 81.
Colouring matters from *Lomatia ilicifolia* and *L. longifolia*, Trans., 784.
—— —— of marine Algæ, ii, 27.
—— —— yellow, compounds of, with acids, Trans., 644.
—— principles of chay root, Trans., 817.
—— —— of the wood of *Artocarpus integrifolia*, Trans., 937.
Combustion, gain of weight in, lecture experiments on, ii, 261.
—— in air, secondary products containing nitrogen formed during, ii, 61.
—— incomplete, of some gaseous carbon compounds, Proc., **1894**, 179.
Combustion, incomplete, oxidation by, i, 271.
Comenic acid, synthesis of, i, 22.
Compounds, unsaturated, attempts to resolve into optically active constituents, ii, 98.
Conductivity. See Electrical conductivity.
Coniceïne, i, 253.
Coniine, action of hydrogen peroxide on, i, 479.
—— existence of, in *Sambucus nigra*, i, 433.
—— pure dextrorotatory, i, 115.
r-Coniine, i, 253.
Conium alkaloïds, i, 253.
"Consolute," ii, 157.
Convolvulin, composition and products of the hydrolysis of, i, 119.
Copaiba balsam, detection of castor oil in, ii, 147.
Copellidine, action of hydrogen peroxide on, i, 683.
iso-Copellidine, i, 683.
Copellidines, stereoisomeric, i, 683.
Copellidinesulphonic acid, i, 683.
Copper, action of nitric acid on, ii, 164.
—— action of nitrous oxide on, ii, 312.
—— action of, on fused ammonium salts, Proc., **1895**, 114.
—— action of, on the animal organism, ii, 321.
—— action of the halogen compounds of phosphorus on, ii, 392.
—— American, refined, analysis of, ii, 186.
—— ammonium dichromate, ii, 355.
—— arsenites, ii, 218.
—— bullion, estimation of tellurium in, ii, 289.
—— chloride, double salts of, ii, 46.
—— —— hydrates of, ii, 227, 269.
—— —— molecular refraction of dissolved, Trans., 836, 844.
—— cyanides, double, i, 485.
—— detection and estimation of, in oils, ii, 463.
—— detection and estimation of small quantities of arsenic in, ii, 31.
—— dichromate, ii, 355.
—— —— mercury cyanide, ii, 356.
—— estimation, electrolytic, of, in ammoniacal solution, ii, 139.
—— ferrocyanide ammonia, i, 407.
—— ferrocyanides, crystalline, i, 405.
—— freezing point of, Trans., 190.
—— hydroxide, precipitated, crystallisation of, ii, 267.
—— iodide from Broken Hill, N.S.W., ii, 504.

Copper nitrate, basic, ii, 315.
—— phosphides, ii, 392.
—— salts, absorption spectra of dilute solutions of, ii, 433.
—— separation of antimony from, ii, 89, 422.
—— separation of arsenic from, ii, 89, 461.
—— separation of cadmium from, ii, 246, 371.
—— separation of manganese from, ii, 332, 419.
—— separation of mercury from, ii, 533.
—— separation of nickel from, ii, 246.
—— separation of tin from, ii, 89, 422, 463.
—— separation of zinc from, ii, 246.
—— specific ionic velocity of, ii, 477.
—— sulphate, commercial, detection of iron in, ii, 534.
—— —— electrolysis of hot solutions of, ii, 4.
—— —— estimation of, ii, 140.
—— —— vapour-pressure of the combined water in, ii, 486.
—— the hydrobromic acid test for, ii, 330.
—— thermal conductivity of, ii, 69.
—— thiohypophosphate, ii, 13.
—— titration of, with sodium sulphide, ii, 64.
—— triphosphate, ii, 446.
—— wet assay of, ii, 419.
—— See also Cupric and Cuprous.
Copper-aluminium alloys, ii, 351, 392.
Copper-tin alloy, $SnCu_3$, ii, 351.
Copper-titanium alloy, ii, 169.
Copper-zinc alloy, Zn_2Cu, ii, 351.
—— —— —— analysis of, ii, 186.
Corallin and dyes associated with it, i, 667.
Corpses, detection and estimation of strychnine in, ii, 542.
—— examination of, for alkaloïds and glucosides, ii, 465.
Corundum, artificial, ii, 275.
—— pyrogenetic, ii, 276.
Corybulbine, Trans., 25.
—— action of hydrogen iodide on, Trans., 28.
—— hydrochloride, Trans., 27.
—— methiodide, Trans., 28.
—— platinochloride, Trans., 27.
—— sulphate, Trans., 27.
Corydalic acid, Trans., 22.
Corydaline, Trans., 17, 21.
—— action of chlorine on, Trans., 17.
—— chloro-, Trans., 17.
—— oxidation of, with potassium permanganate, Trans., 17.
Corydaline, specific rotation of, Trans., 17.
Corydalinic acid, action of hydrogen iodide on, Trans., 21.
—— —— constitution of, Trans., 24.
Corydalis cava, alkaloïds of, Trans., 25.
Cotinine, rotatory power of, i, 116.
—— dibromo-, rotatory power of, i, 116.
Coto bark, true, crystalline constituents of, i, 110.
Cotoïn, compound of, with phenylcoumalin, i, 554.
Cotton cake, effect on butter of feeding with, ii, 299.
—— dyed with alizarin, analyses of, i, 108.
o-Coumaraldehyde methyl ether from oil of cassia, i, 289.
—— —— —— oxime and phenylhydrazone of, i, 279.
Coumaran, i, 280.
Coumarin formation, velocity of, i, 140.
—— new synthesis of, i, 419.
Coumarincarboxylates, i, 419.
Coumarone, action of nitrous acid on, i, 475.
—— constitution of, i, 533.
—— nitrosite of, i, 475.
Cow, colostrum of, ii, 81.
β-Cresotic acid, salts of, i, 366.
m-Cresotic acid, basic bismuth salt of, i, 92.
p-Cresotic acid, basic bismuth salt of, i, 92.
Critical density, ii, 6.
—— state, ii, 6, 71.
—— temperature, ii, 6.
Crossite, from Berkeley, California, ii, 513.
Croton oil, detection of castor oil in, ii, 147.
—— —— vesicating constituent of, i, 680.
—— resin, i, 680.
Crotonic acid, dibromo-, from tetrolic acid, i, 591.
—— —— tetrabromo-, i, 592.
Cryohydrates of pairs of compounds, ii, 438.
Cryosalts, ii, 438.
"Crystal violet," action of bromine on, i, 56.
Crystallisation, emission of light during, ii, 66, 429.
—— influence of low temperatures on the laws of, ii, 42.
Crystallography, use of the globe in the study of, Proc., **1894**, 226.
Crystals, formation of, at the bottom of a solution heavier than themselves, ii, 384.

Crystals, mixed, of pairs of isomorphous salts, solubility of, ii, 7.
Cryoscopic behaviour of substances having a constitution similar to that of the solvent, ii, 205.
—— behaviour, the volume changes attending the mixture of liquids in relation to, ii, 6.
—— molecular weight determinations, ii, 41.
—— properties and rotatory power, connection between, ii, 194.
Cryoscopy, *p*-xylene as a solvent in, ii, 207.
—— See also freezing point.
Cubebin, i, 24.
—— dibromo-, i, 24.
Cucurbita pepo, crystalline nitrogen compounds in the seedlings of, ii, 84.
Cumengite, ii, 115.
Cuminylbenzoïnazine, i, 607.
ψ-Cumylnitramine, i, 274.
Cuprammonium acetate, i, 330.
—— double salts, i, 329, 330.
—— formochloride, i, 329.
—— lactobromide, i, 330.
—— lactochloride, i, 330.
—— propionobromide, i, 329.
Cupric hydride, ii, 268.
Cupriferrocyanides, i, 406.
Cuprocassiterite from the Black Hills, Dakota, ii, 21.
Cuproferrocyanides, i, 406.
Cuprous oxide, action of nitrous oxide on, ii, 312.
—— selenide, crystallisation of, ii, 391.
—— sulphide, crystallisation of, ii, 391.
Cuprousacetylcarbamide, i, 270.
Currants, analysis of, ii, 366.
Cuskhygrine, i, 310.
Cyanacethydrazide, i, 263.
Cyanacetoacetic acid, action of phenylhydrazine on the ethereal salts of, i, 648.
Cyanacetonephenylhydrazone, i, 583.
Cyanacetophenone, isonitroso-, i, 584.
Cyanacetophenonephenylhydrazone, i, 584.
Cyanacetylacetonehydrazine, i, 263.
Cyanal, i, 258.
—— acetate, i, 258.
—— propionate, i, 258.
Cyanamide, conversion of carbamide into, i, 411.
—— derivatives of, i, 461.
Cyanic colouring matters, physiological meaning of, ii, 27.
Cyanides, electrolytic dissociation of, ii, 478.
Cyanides, metallic, action of picric acid and picrates on, i, 131.
—— —— action of reducing agents on, i, 121.
iso-Cyanides, bivalent carbon contained in, i, 9.
β-Cyano-ω-benzylacetophenone, i, 361.
Cyanocaffeïne, i, 628.
—— physiological action of, ii, 238.
α-Cyanocinnamide, i, 651.
α-Cyanodeoxybenzoïn, i, 585.
o-Cyanodiphenylmethane, i, 53.
Cyano-ethers, i, 257.
iso-Cyanoethylic dichloride, i, 9.
α-Cyano-β-furfurylacrylamide, i, 651.
α-Cyano-β-furfurylacrylic chloride, i, 651.
Cyanogen, alleged liberation of carbon from, in flames, TRANS., 1061.
—— chloride, action of, on ethylic ether, i, 257.
—— compound of aluminium chloride with, i, 637.
—— compounds, change of, in the body, ii, 238.
—— incomplete combustion of, PROC., **1894**, 180.
Cyanomaclurin, TRANS., 939.
Cyanomethyl *p*-tolyl ketone, i, 584.
—— —— —— phenylhydrazone, i, 585.
Cyanomethylenecamphor, i, 64.
Cyano-*iso*-nitrosoacetohydroxamic acid, i, 11.
α-Cyanophenylmethyl benzyl ketone, i, 585.
β-Cyano-γ-phenyl-ψ-carbostyril, i, 393.
iso-Cyanophenylpyruvamide, i, 102.
—— nitro-, i, 102.
Cyano-*iso*-quinoline, i, 393.
Cyano-*m*-xylylidenephthalide, i, 536.
—— dinitro-, 1, 536.
Cyanuric acid, preparation of, PROC., **1895**, 148.
Cyaphenine, i, 344.
—— trinitro-, i, 344.
Cyclohexane, isomerides of, i, 454.
Cyclopentenedicarboxylic acid, conversion of pimelic acid into, i, 338.
Δ^1-1 : 2-Cyclopentenedicarboxylic acid, i, 338.
—— anhydride, i, 338.
Cyphelium chrysocephalum, vulpic acid from, i, 298.
Cysteïn, formation of α-thiopropionic acid from, i, 691.
Cysts, ovarian, colloïd material formed in, ii, 361.
Cytisine, i, 254.
—— and ulexine, identity of, i, 119.
—— bromination of, i, 159.
—— identity of scopoline with, i, 159.
—— reactions of, i, 159.

D.

Daniell cell, E.M.F. of, ii, 475.
Daphnia, action of drugs on the heart of, ii, 57.
Daturic acid, i, 331.
Davyn from Vesuvius, ii, 50.
Deacon process, crystallised products formed in the, ii, 75.
Decarbusneïn, i, 299.
Decylene, magnetic rotation of, Trans., 257.
Dehydrodioxydinaphthylic sulphide, i, 104, 237.
—— —— phenylhydrazide of, i, 104.
Dehydronicotine, constitution of, i, 309.
Density and molecular weight of liquid and solid substances, relation between, ii, 307.
—— critical, ii, 6.
—— of saturated vapours, ii, 342.
Deoxybenzoïn, action of sodium ethoxide on, Trans., 604.
—— action of sodium methoxide on, Trans., 605.
Deoxybenzoïnbenzylideneacetophenone, i, 48.
Deoxybenzoïnbenzylideneacetylacetone, i, 50.
Deoxybenzoïnbenzylidene-*p*-methoxyacetophenone, i, 49.
Deoxybenzoïn-*p*-cinnamoylanisoïl, i, 49.
Desylacetic acid, Trans., 137.
Desyleneacetic acid, Trans., 137.
Desylenemalonic acid, Trans., 135.
Deviation, molecular and molecular rotation, ii, 473.
Dextrose. See Glucose.
Diabetes, excretion of acetone, acetoacetic acid and β-hydroxybutyric acid in, ii, 281.
—— influence of levulose in, ii, 281, 520.
—— metabolism in, ii, 406.
α-Diacetonitrile (labile), i, 582.
—— action of carbanil on, i, 583.
β-Diacetonitrile (stable), i, 582.
—— action of carbanil on, i, 583.
—— action of carbonyl chloride on, i, 582.
—— action of cyanamide on, i, 583.
—— action of diazobenzene chloride on, i, 583.
—— action of ethylic chlorocarbonate on, i, 582.
—— action of hydrazine sulphate on, i, 583.
—— and benzaldehyde, condensation of, i, 584.
—— bromo-, i, 582.
—— chloro-, i, 582.
Diacetoxymethoxynaphthalene, iodo-, i, 237.
Diacetyl, aldol of, i, 647.
Diacetylacetone, action of diazobenzene chloride on, i, 499.
Diacetylacetone, condensation of, with ethylic acetoacetate, i, 499.
—— preparation of, i, 498.
Diacetylacetonedioxime, i, 498.
—— anhydride, i, 498.
Diacetylaconitine, Trans., 462.
Diacetylamidocarvacrol methyl ether, i, 546.
Diacetyl-*p*-amidophenylauramine, i, 184.
Diacetyl-*p*-amidophenylmethylcarbinol, i, 178.
Diacetyl-*p*-amidophenylthiocarbamide, i, 184.
Diacetyl-*p*-amidophenylthiocarbimide, i, 184.
Diacetylbenzaconine, Trans., 459.
Diacetylbenzeneazo-β-naphthaquinol, i, 617.
Diacetylbenzenehydrazo-β-naphthaquinol, i, 617.
Diacetylbenzophenonedicarboxylic acid, i, 422.
Diacetylbenzyl-*o*-amidobenzylaniline, i, 133.
Diacetyl-*p*-*iso*-butylsalicylaldehyde, i, 222.
Diacetylcreatine, i, 310.
Diacetyl-4 : 2′-diamidobenzophenone, i, 233.
Diacetyl-2 : 4′-diamidodiphenylmethane, i, 233.
Diacetyl-4 : 4′-diamidodiphenylmethane, i, 233.
Diacetyldiamidoditolylmethane, i, 148.
Diacetyl-*p*-diamidophenylic bisulphide, i, 87.
—— sulphide, i, 87.
Diacetyldibenzoylacetone, i, 499.
Diacetyldi-*o*-bromaniline, i, 594.
Diacetyldifurfuryldihydrotetrazine, i, 271.
Diacetyldifurfuryl-*iso*-dihydrotetrazine, i, 271.
Diacetyldifurfurylimidine, i, 271.
Diacetyl-2 : 3-dihydroxyanthracene, i, 544.
Diacetyl-1 : 2-dihydroxy-3 : 4-naphthacridone, i, 107.
Diacetyl-αβ-dihydroxynaphthaphenazine, i, 616.
1 : 2-Diacetyl-3 : 4-dimethylpyrazolone, i, 687.
Diacetyldiphenylketipamidonitrile, i, 102.
Diacetyldi-*p*-tolenylhydrazidine, i, 137.
Diacetylethylimidoethylthiourazole, i, 402.

Diacetylgallic acid, i, 283, 420.
Diacetyl-*o*-hydroxybenzyl-*o*-phenylenediamine, i, 346.
Diacetylhydroxylapachol, Trans., 791.
Diacetylilicene, i, 182.
Diacetylimidodithiourazole, i, 401.
Diacetylmethyl-*p*-amidophenylcarbinol, i, 178.
Diacetylnaphthazarin, i, 613.
—— chloro-, i, 613.
Diacetyl-1 : 3-naphthylenediamine, i, 668.
Diacetylphenyldithiourazole, i, 402.
αβ-Diacetylphenylhydrazine, tribromo-, i, 604.
1 : 2-Diacetyl-3-phenyl-*iso*-pyrazolone, i, 687.
Diacetylphthalylhydrazide, i, 355.
Diacetylphyscion, i, 299.
Diacetylpinoresinol, i, 109.
Diacetylquinonedioxime, stereoisomeric forms of, i, 217.
Diacetylracemic nitrile, i, 22.
Diacetylthymoquinonoxime, isomeric forms of, i, 529.
Diacetyltoluquinol, nitro-, i, 513.
Diacidyltartrates, i, 173.
Diallyl, magnetic rotation of, Trans., 258.
Diamide, metallic double salts of, ii, 10.
Diamido-ethers, i, 170.
Diamines, action of chloroform and potash on, i, 568.
—— aromatic, action of saligenin on, i, 346.
o-Diamines, i, 57.
—— aromatic, oxidation of, i, 24, 25.
—— conversion of hydrazines into, i, 520.
Diammonium (hydrazine) cadmium chloride, ii, 11.
—— double metallic salts of, ii, 10.
—— mercuric chloride, ii, 11.
—— stannous chlorides, ii, 11.
—— zinc chloride, ii, 11.
Diamyl, rotatory power of, ii, 97.
iso-Diamyl, amido-, i, 633.
—— nitro-, i, 633.
Diamylacetic acid, rotatory power of, ii, 149.
Di-*iso*-amylcarbamide, Trans., 564.
Diamylene, magnetic rotation of, Trans., 257.
Diamyloxymethane, i, 14.
Di-*iso*-amylurea, Trans., 564.
Dianilidobenzene, bromo-1 : 3-dinitro-, i, 212.
Dianilidodi-*α*-naphthylthiocarbamide, i, 601.
Dianilidonitroquinone, i, 513.
Dianilinediphenylamine-*n*-phosphine oxide, i, 364.
Dianiline-*n*-phosphinic acid, di-*p*-chloro-, i, 364.
Diastase, action of, on starch, Trans., 702, 739.
—— action of, on starch paste in the cold, Trans., 309.
—— in blood-serum and saliva, ii, 53.
—— of kiln-dried malt, action of, on maltose, Trans., 743.
—— —— —— —— action of, on starch, Trans., 707, 744.
Diazoacetylmethane, i, 328.
Diazoamidobenzene, *m*-dinitro, m. p. of, Trans., 51.
—— *o*-dinitro-, preparation and properties of, Trans., 52.
—— *p*-dinitro-, i, 215.
—— —— m. p. of, Trans., 50.
—— *o*-nitro-, i, 216.
Diazoamidobenzenes, dinitro-, action of phthalic chloride on, i, 134.
—— isomeric dinitro-, and their melting points, Trans., 50.
Diazoamidomesitylene, *p*-nitro-, i, 351.
β-Diazoamidonaphthalene, 1 : 1' : 4 : 4-dichlorodibromo-, Trans., 911.
Diazoamidotoluene, *p*-nitro-, i, 351.
Diazobenzene, alkylic salts of, i, 215.
—— aniline chloride, i, 275.
—— benzenesulphinic acids of, derivatives of, i, 371.
—— bromide, i, 350.
—— —— tribromo-, i, 350.
—— chloride, diiodo-, i, 350.
—— —— trichloro-, i, 350.
—— cyanide, hydrocyanide, i, 348.
—— —— *p*-chloro- and *p*-nitro-, i, 348.
—— derivatives, stereoisomerism of, i, 371.
—— ethyl ether, *p*-nitro-, i, 216.
—— iodide, diiodo-, i, 350.
—— methyl ether, i, 216.
—— —— —— *o*-nitro-, 216.
—— —— —— *p*-nitro-, i, 134. 216.
—— nitrate, 2 : 4-dinitro-, i, 30.
—— —— *p*-nitro-, explosiveness of, i, 275.
—— potassium sulphites, the isomeric, i, 274.
—— salts, mononitro-, action of ethylic cyanacetate on, i, 274.
anti-Diazobenzene cyanide, chloro-, i, 348.
—— —— nitro-, i, 349.
iso-Diazobenzene hydroxide, *p*-nitro-. conversion of, into *p*-nitrodiphenyl, i, 289.
—— —— —— piperidine salt of, i, 351.

syn-Diazobenze cuprobromide, i, 519.
—— —— *p*-bromo-, i, 520.
—— cyanide, chloro-, i, 348.
—— —— nitro-, i, 349.
Diazobenzene-*p*-acetotoluidide, i, 347.
Diazobenzene-*p*-diazotolueneanilide, i, 215.
Diazobenzene-*p*-diazotoluenetoluidide, i, 215.
Diazobenzenesulphonic acid, action of soda on, i, 369.
m-Diazobenzenesulphonic acid, action of alcohols on, i, 520.
anti-Diazobenzenesulphonic acid, sodium salt of, i, 665.
syn-Diazobenzenesulphonic acid, sodium salt of, i, 665.
Diazobenzenetolylguanidine, chloro-, i, 659.
Diazochlorides, aromatic, maximum temperature of formation and temperature of decomposition of, i, 514.
Diazo-compounds, i, 350.
—— —— action of ethylic cyanacetate on, i, 659.
—— —— aromatic, i, 215.
—— —— —— action of alkali sulphites on, i, 370.
—— —— constitution of, i, 515, 516, 661.
—— —— fatty, action of alkali sulphites on, i, 642.
—— —— normal, i, 516.
—— —— —— constitution of, i, 349.
—— —— stereoisomeric, formation of dyes from, i, 26.
—— —— stereoisomerism of, i, 180.
—— —— theory of, i, 274.
iso-Diazo-compounds, changes occurring in the conversion of, into normal compounds, i, 350.
Diazocyanides, stereoisomeric, i, 348.
Diazo-derivatives, isomeric, i, 661.
Diazo-ethers, configuration of, i, 25.
—— —— isomerism of, i, 369.
Diazohalogen salts, constitution of, i, 349.
Diazohaloïd compounds, i, 516.
iso-Diazo-hydrates, constitution of, i, 459.
—— —— conversion of, into derivatives of diphenyl, i, 289.
Diazomethane, i, 493.
—— preparation, properties and reactions of, i, 329.
—— synthesis of, i, 494.
Diazonaphthalene methyl ether, i, 216.
Diazonium compounds, i, 516.
Diazo-salts, i, 274.
—— —— alkylic, i, 215.
—— —— anhydrous, preparation of, i, 669.
Diazosulphanilic acid and its stereoisomeric salts, i, 664.
—— —— constitution of, i, 664.
—— acids, isomerism of, i, 369.
Dibenzamide, behaviour of, in the animal organism, ii, 280.
—— synthesis of, i, 289.
Dibenzenylamidoxime, thiocarbonate, i, 662.
Dibenzhydroxamic acid, i, 39.
Dibenzoyl-β-arabinochloral, i, 321.
Dibenzoyl-*p*-*iso*-butylsalicylaldehyde, i, 222.
Dibenzoylcarbamide, action of heat on, i, 305.
Dibenzoylcotoïn, i, 110.
Dibenzoyl-φ-diamidohexane, i, 261.
Dibenzoyl-χ-diamidohexane, i, 261.
Dibenzoyldipiperidyl, i, 434.
Dibenzoylhydrazine, di-*m*-nitro-, i, 277.
—— di-*o*-nitro-, i, 277.
—— di-*p*-nitro-, i, 277.
—— symmetrical, i, 34.
Dibenzoylilicene, i, 182.
Dibenzoylmethylpiperazine, i, 570.
Dibenzoyl-*p*-nitrosoaniline, i, 598.
Dibenzoyloctohydro-α-quinoquinoline, i, 244.
Dibenzoyl-*o*-phenolbenzylamine, i, 537.
Dibenzoylphenylethylenediamine, i, 273.
—— trinitro-, i, 274.
Dibenzoylphenylmethane, Proc., **1895**, 147.
Dibenzoylphyscion, i, 299.
Dibenzoylpinoresinol, i, 109.
Dibenzoylquinone-*bis*-amidobenzoic acid, i, 533.
Dibenzoyltartaric acid, i, 267.
—— anhydride, i, 267.
Dibenzoylthiocarbamide, i, 461.
Dibenzoylxylosochloral, i, 321.
Dibenz-*p*-toluhydroxylamines, i, 41.
Dibenzyl, amido-, i, 634.
—— nitro-, i, 634.
Dibenzyl ketone, action of ethylic oxalate on, i, 373.
Dibenzylamine, *o*-nitro-, i, 307.
Dibenzylbenzenes, synthesis of, i, 130.
Dibenzyl-*p*-*iso*-butylsalicylaldehyde, i, 223.
Dibenzyldisulphonic acid, dinitro-, i, 287.
Dibenzylidene-*o*-amidobenzyl-*p*-phenetylhydrazine, i, 32.
Dibenzylideneamidobenzylphenylhydrazine, i, 32.
Dibenzylidenediphenylhydrotetrazone, action of alcoholic potash on, Trans., 611.
Dibenzylidenerosaniline, dinitro-, i, 234.
Dibenzyllophonium benzoate, Trans., 42.

Dibenzyllophonium chloride, Trans., 36.
—— dibenzoate, Trans., 41.
—— hydroxide, Trans., 40.
—— nitrate, Trans., 42.
Dibenzyloxalylcarboxylic acid, lactone of, i, 100.
Di-*iso*-butoxymethane, i, 14.
iso-Dibutyl, amido-, i, 633.
—— diamido-, i, 633.
—— dinitro-, i, 633.
—— nitro-, i, 633.
ab-Di-*iso*-butylcarbamide, Trans., 560.
ab-Di-*sec*-butylcarbamide, Trans., 561.
Di-*tert*-butylcarbamide, symmetrical, i, 588.
p-Di-*iso* butyldisalicylaldehyde, i, 222.
ab-Di-*iso*-butylurea, Trans., 560.
ab-Di-*sec*-butylurea, Trans., 561.
Dibutyrylethylenediamine, i, 481.
Dicampholyl, i, 384.
Dicampholylic alcohol, i, 384.
Dicarbamide, i, 12.
Dicarbon compounds, formation of, from carbon bisulphide at low temperatures, i, 77.
β-Dicatecholacetic acid, i, 367.
Dichromate group, specific ionic velocity of, ii, 477.
Dichromates of the heavy metals, ii, 355.
Dichlorhydrin nitrite, i, 23.
Dicinnamoyltartaric anhydride, i, 268.
"Dicotoïn," i, 110, 554.
ψ-Dicotoïn, i, 110.
Dicyanogen, poisonous action of, ii, 129.
Didymium oxides, ii, 449.
Diemyctylus viridescens, red pigment of, ii, 174.
Diet, standard normal, ii, 78.
Diethoxyacetone, i, 334.
1 : 3-Diethoxybenzene, 2 : 4 : 5-tribromo-, i, 212.
Di-*p*-ethoxydiphenylformazylformic acid, i, 575.
Di-*p*-ethoxydiphenyltetrazoliumbetaïne, i, 575.
Di-*p*-ethoxydiphenyltetrazoliumcarboxylic acid chloride, i, 574.
Diethoxymethane, i, 14.
αγ-Diethoxypicoline, Trans., 411.
Diethoxytriphenylmethane-*o*-carboxylic acid, i, 376.
Diethyl ketone, action of ethylic oxalate on, i, 373.
Diethylacetic acid, affinity constant of, ii, 253.
p-Diethylamidobenzylamine, i, 414.
Diethylamidohydroxy-*iso*-butyric acid, i, 682.
m-Diethylamidophenol, i, 146,
Diethylamine, dithio-, i, 200.
—— thio-, i, 430.
Diethylaniline, use of, for eliminating hydrogen bromide from bromo-compounds, i, 17.
2 : 4-Diethyldiazothiolid-5-on, 3-thio-, i, 578.
—— bromo-, i, 578.
1 : 3-Diethylhexamethylene, i, 454.
1 : 3-Diethylketohexamethylene, i, 454.
Diethylmethylal, dichloro-, i, 267.
Diethylphenolphthaleïn, i, 376.
Diethylselenitine hydroxide, i, 8.
—— salts, i, 8.
Diethylthiocarbimine bisulphide, i, 578.
Diformylhydrazine, i, 263.
αβ-Diformylphenylhydrazine, i, 354.
Difurfuryldihydrotetrazine, i, 271.
Difurfuryl-*iso*-dihydrotetrazine, i, 271.
Difurfurylhydrazidine, i, 271.
Difurfurylimidine, i, 271.
Difurfuryltetrazine, i, 271.
Difurfuryltriazole, i, 271.
Digestibility of pentosans, ii, 278.
Digestion, artificial, of the nitrogenous constituents of food by Kuhn's method with pepsin solution, ii, 516.
—— comparative, of sugar-beet, mangel wurzel, and distillery roots, ii, 452.
—— gastric, of proteïds, ii, 77.
—— of horny tissue by trichophytic fungi, ii, 457.
—— of oats by rabbits, ii, 120.
—— of pentosans, ii, 278, 404.
—— of pseudo-nucleïn from caseïn, ii, 278.
—— pancreatic, leucine from, i, 83.
—— —— of albumin, ii, 233.
—— peptic, ii, 232.
—— —— behaviour of the phosphorus of caseïn in, ii, 119.
Digic acid, i, 66.
Digitogenic acid oxime, i, 65.
—— —— preparation of, i, 65.
Digitogenin derivatives, i, 65.
Diglycollic acid, thio-, i, 82.
Diheptenyl, i, 186.
Dihexylic ether, i, 590.
Dihydrocampholenolactone, i, 676.
—— nitroso-, constitution of, i, 677.
Dihydrocampholytic acid, amido-, derivatives of, i, 187.
—— —— —— inner anhydride of, i, 187.
Dihydrocarveol, constitution of, i, 675.
—— hydrobromide, glycol from, i, 550.
—— oxidation of, i, 674.
Dihydrocarvone, α-dibromo-, i, 551.
—— α-dichloro-, i, 551.
—— diketone from, i, 675.
—— hydrobromide, constitution of, i, 550.
—— physical properties of, i, 673.
—— tribromide, i, 622.

i-Dihydrocarvone, bisnitrosobromo-, i, 551.
—— dibromo-, i, 551.
—— dichloro-, i, 551.
Dihydroeucarvylamine, i, 152.
Dihydroglyoxalines, i, 567.
Dihydromethylcoumaran, i, 279.
Dihydro-oxalyldibenzyl ketone, i, 375.
Dihydrophenonaphthacridine, i, 107.
$\Delta^{2,6}$-Dihydrophthalic acid, resolution of, into active components, i, 141, 153.
Dihydrophthalic acids, separation of, i, 141, 153.
Dihydropiperonylenemalonic acid, i, 468.
Dihydroquinoline, König's, i, 69.
Dihydroquinolines, i, 69.
—— properties of, i, 111.
Dihydro-*iso*-thujole, i, 620.
2:3-Dihydrotoluene, 5-chloro-, i, 86.
Dihydroxyacetone, preparation of, i, 496.
2 : 2′-Dihydroxy-4-anilidonaphthaquinone, i, 106.
2 : 3-Dihydroxyanthracene, i, 544.
2 : 2′-Dihydroxybenzophenone, i, 233.
2 : 4′-Dihydroxybenzophenone, i, 233.
3 : 2′-Dihydroxybenzophenone, i, 233.
4 : 4′-Dihydroxybenzophenone, i, 233.
Dihydroxybenzoylbenzoic acids and their bromo-derivatives, condensation of, i, 235.
o-Dihydroxybenzylidenediamidoethoxydimethyldiphenyl, i, 27.
β-Dihydroxydihydrocampholenic acid, i, 677.
α-*anti*-Dihydroxydihydrocampholenic acid, i, 676.
α-*syn*-Dihydroxydihydrocampholenic acid, i, 676.
Dihydroxy-ββ-dinaphthaquinone, Trans., 662.
Di-β-hydroxydinaphthylic bisulphide, i, 104.
—— —— dithio-, i, 104.
—— sulphide, i, 104.
iso-Dihydroxydinaphthylic sulphide, i, 104.
4:4′-Dihydroxydiphenylmethane, nitro-, i, 233.
3 : 4-Dihydroxydiphenylpentamethylene-1-carboxylic acid, i, 666.
—— —— isomeride of, i, 666.
Di-*p*-hydroxydiphenylformazylformic acid, i, 575.
Di-*p*-hydroxydiphenylsulphone, i, 144.
Di-*p*-hydroxydiphenyltetrazoliumbetaïne, i, 574.
ab-Di-*p*-hydroxydiphenylthiocarbamide, Trans., 559.
αβ-Dihydroxy-*iso*-heptoic acid, i, 207.
Dihydro-*m*-xylene, 5-chloro-, i, 86, 654.
Dihydroxymethoxynaphthaquinone, iodo-, i, 237.
Dihydroxymethylpropyldiphenylsulphone, i, 471.
1 : 2-Dihydroxy-3 : 4-naphthacridone, i, 107.
2 : 4-Dihydroxynaphthalene, 1-amido-, i, 237, 617.
2 : 2′-Dihydroxynaphthalene-4-sulphonic acid, 1-amido-, i, 106.
αβ-Dihydroxynaphthaphenazine, i, 616.
1 : 2-Dihydroxy-1′ : 4′-naphthaquinone, identity of naphthazarin with, i, 151.
—— oxime of, i, 151.
αβ-Dihydroxynaphtheurhodole, i, 616.
αβ-Dihydroxy-*iso*-octoic acid, i, 208.
Dihydroxyphenylbutyranilide, bromo-, i, 93.
Dihydroxyphenylbutyric anhydride, amido-, i, 93.
—— phenylhydrazide i, 93.
Dihydroxyphenylnaphthylsulphone, derivatives of, i, 471.
αβ-Dihydroxyphenylvaleric acid, i, 225.
βγ-Dihydroxyphenylvaleric acid, i, 225.
αγ-Dihydroxypicolinic acid, Trans., 409.
Dihydroxyselenoanisoïl, i, 341.
Dihydroxyselenophenetoïl, i, 341.
Dihydroxystearic acid, i, 82.
—— —— condensation product of, i, 501.
—— —— natural, i, 500.
Dihydroxystearic acid (?), i, 501.
Dihydroxystearosulphuric acid, i, 82.
Dihydroxytartaric acid, preparation of, Trans., 48.
iso-Diketocamphoric acid, i, 676.
Diketohexamethylene from succinic acid, i, 339.
Diketonaphthaphenazine, i, 615.
αβ-Diketonaphthaphenazine, i, 616.
Diketone from dihydrocarvone, i, 675.
α-Diketones, i, 647.
—— condensation of *o*-toluidine with, i, 666.
—— conversion of ketones into, i, 499.
o-Diketones, action of *p*-amidophenol on, i, 214.
—— interaction of, with primary amines, Trans., 32.
1 : 5-Diketones, i, 48.
γθ-Diketosebasic acid, i, 335.
αα-Diketotetrahydronaphthalene oxide, i, 615.
—— —— action of *o*-phenylenediamine on, ii, 616.
Diketoximebehenic acid, i, 208.
Diketoximestearic acid, i, 208.
Dimethoxyacetophenone, i, 43.
2 : 3-Dimethoxyanthracene, i, 544.
2 : 5-Dimethoxy-*o*-benzoylbenzoic acid, i, 232.

3 : 4-Dimethoxy-*o*-benzoylbenzoic acid, i, 232.
Di-*p*-methoxydiphenylformazyl hydride, i, 575.
Dimethoxymethane, i, 14.
αβ-Di-*p*-methoxyphenylglyoxaline μ-hydrosulphide, i, 305.
Di-*p*-methoxytolaneureïn, i, 305.
Dimethyl diketone, preparation of, i, 499.
2 : 4-Dimethyl-3-acetylpyrroline, i, 68.
2 : 4-Dimethyl-3-acetylpyrroline-5-carboxylic acid, i, 68,
2 : 4-Dimethyl 5-acetylpyrroline-3-carboxylic acid, i, 68.
Dimethylacrylic acid, preparation of, i, 17.
Dimethylalloxan, derivatives of, i, 83.
Dimethylamidoacetone, i, 682.
Dimethylamidoacetoxime, i, 682.
Dimethyl-*p*-amidobenzaldehyde, condensation of, with *m*-amidodimethylaniline, i, 214.
—— derivatives of, i, 221.
p-Dimethylamidobenzoic acid, i, 176.
—— —— reduction of, i, 91.
p-Dimethylamidobenzylamine, i, 414.
p-Dimethylamidobenzylic acetate, i, 178.
—— alcohol, i, 176.
p-Dimethylamidobenzylidene-*p*-amidodimethylaniline, i, 214.
Dimethylamidocollidine, i, 565.
Dimethylamidodibenzyldi-*p*-carboxylic acid, i, 414.
Dimethyl-*m*-amidodiphenylamine, dinitro-, i, 278.
p-Dimethylamidohexahydrobenzoic acid, i, 91.
Dimethylamidohydroxy-*iso*-butyric acid, i, 682.
Dimethyl-*m*-amidophenol, i, 146.
2-Dimethylamido-2′-phenylquinoline, i, 72.
2-Dimethylamido-2′-phenylquinoline-4′-carboxylic acid, i, 72.
α-Dimethylamidoquinoline methiodide, i, 156.
ω-Dimethylamido-*p*-toluamide, i, 414.
ω-Dimethylamido-*p*-toluic acid, i, 414.
Dimethylamine, dithio-, i, 200.
—— nitration of, i, 251, 261.
Dimethylammonium oxalate, i, 450.
Dimethylanilethylquinonimide, i, 417.
Dimethylaniline, nitroso-, action of, on mixtures of aromatic amines and formaldehyde, i, 213.
Dimethylanilquinonimide, i, 416.
Dimethylanilthymoquinonimide, i, 417.
Dimethylanil-*m*-toluquinonimide, i, 416.
Dimethylanil-*o*-toluquinonimide, i, 416.
Dimethylanil-*p*-xyloquinonimide, i, 416.
Dimethylasparagine, action of methylic iodide on, i, 591.
Dimethylbarbituric acid, dichloro-, i, 83.
—— —— nitro-, i, 337.
2 : 4-Dimethylbiazthiolid-5-on, 3-thio-, i, 576.
Dimethylcarbamic chloride, i, 450.
αα-Dimethylcarbamide, TRANS., 563.
Dimethyldialuric acid, i, 83.
Dimethyldiamidodiphenylmethane, nitro- and dinitro-, i, 99.
Dimethyldiazidodiphenylmethylic oxide, i, 423.
Dimethyldiazidomethyldiphenylchloromethane, salts of, i, 423.
Dimethyldiethylpyrazine, oxidation of, i, 498.
Dimethyldinitrosoamidodiphenylmethane, i, 99.
Dimethyldiphenyldisulphone-*p*-phenylene diamine, i, 144.
Dimethylethylcarbinol, heat of vaporisation of, ii, 101.
Dimethylethylpyrazine, i, 569.
Dimethylformamide, i, 450.
Dimethylfurazan, i, 192.
Dimethylglutaranil, i, 210.
Dimethylglutaranilic acid, i, 210.
$\alpha\alpha_2$-Dimethylglutaric acids, TRANS., 416; i, 210, 505.
cis-$\alpha\alpha_2$-Dimethylglutaric acid (maleinoïd), TRANS., 428; i, 210, 505.
—— anhydride, TRANS., 429; i, 210, 505.
trans-$\alpha\alpha_1$-Dimethylglutaric acid (fumaroïd), TRANS., 429; i, 210, 505.
ββ-Dimethylglutaric acid, i, 411.
—— anhydride, i, 411.
αα-Dimethylglutarimide, i, 210.
αα-Dimethylglutar-α-naphthil, i, 210.
αα-Dimethylglutar-β-naphthil, i, 210.
αα-Dimethylglutar-α-naphthilic acid, i, 210.
αα-Dimethylglutar-β-naphthilic acid, i, 210.
αα-Dimethylglutar-*p*-tolil, i, 210.
αα-Dimethylglutar-*p*-tolilic acid, i, 210.
Dimethylglyoxalidine (Lysidine), i, 73.
1 : 4-Dimethylglyoxaldine, i, 481.
Dimethylheptenylamidine, symmetrical, salts of, i, 265.
—— unsymmetrical, salts of, i, 265.
1 : 3-Dimethylhexamethylene, i, 339.
—— alcohol, i, 339.
Dimethylimidazole, i, 685.
Dimethylimidazolone, i, 685.
Dimethylimidazolyl hydrosulphide, i, 685.
2 : 5-Dimethylimidodimethylene trisulphide, i, 577.
—— —— bromo-, i, 578.

2′ : 3′-Dimethylindole, synthesis of, i, 475.
Dimethylisophthalic acid, i, 283.
1 : 3-Dimethylketohexamethylene, Trans., 349, 350, 351; i, 339.
1 : 3-Dimethylketohexamethylene oxime, Trans., 351; i, 339.
3 : 5-Dimethyl - Δ_2 - ketotetrahydrobenzene, bromide and dibromide of, i, 52.
—— oxime of, i, 52.
—— phenylhydrazone of, i, 52.
δ-Dimethyllevulinic acid, i, 207.
Dimethylmalonylcarbamide, isonitroso-, i, 336.
1 : 4-Dimethylnaphthol, i, 424.
1 : 4-Dimethylnaphthylamine, i, 425.
Dimethylnitrobarbituric acid, i, 84.
Dimethyloxalyldibenzyl ketone, i, 375.
Dimethyloxamamide, i, 450.
Dimethyloxamic acid, i, 450.
Dimethyloxamide, unsymmetrical, i, 450.
2 : 5 : 4-Dimethylphenyldihydroglyoxaline, i, 567.
Dimethyl-*m*-phenylenediamine, nitro-, compound of, with symmetrical trinitrobenzene, i, 653.
—— *p*-nitroso-, i, 599.
—— symmetrical, i, 600.
—— —— *p*-nitroso-, i, 600.
Dimethyl-*m*-phenylenedinitrosamine, i, 599.
anti-aa′-Dimethylpimelic acid, properties of, Trans., 151.
p-aa′-Dimethylpimelic acid, isolation of, Trans., 145.
—— —— properties of, Trans., 150.
Dimethylpimelic acids, crystalline forms of the isomeric, Proc., **1895**, 8.
aa′-Dimethylpimelic acids, stereoisomeric, Trans., 139.
anti-aa′-Dimethylpimelic anilide, Trans., 154.
p-aa′-Dimethylpimelic anilide, Trans., 154.
Dimethylpinoresinol, i, 109.
Dimethylprotocatechuic acid, dibromo-, i, 656.
Dimethylpseudouric acid, i, 84.
Dimethylpyrazine, preparation of, i, 569.
3 : 4-Dimethylpyrazolone, i, 687.
—— oxidation of, i, 687.
—— 4-nitroso-, i, 687.
3 : 4-Dimethylpyrazolone-4-azobenzene, i, 687.
αα′-Dimethylpyridine, γ-chloro-, Trans., 400.
Dimethylpyrroline, from the dry distillation of ethylic β-amidocrotonate, Trans., 220.
"Dimethylquinogen," real nature of, i, 647.
1 : 3-Dimethylquinophthalone, i, 566.
—— nitro-, i, 566.
1 : 3-Dimethylquinophthalonesulphonic acid, i, 566.
Dimethylresacetophenone, i, 43.
"B_1-Dimethylrosinduline," real nature of, i, 611.
Dimethylsafraninone, i, 219.
Dimethylsuccinanil, i, 505.
Dimethylsuccinanilic acid, i, 595.
Dimethylsuccin-β-naphthil, i, 505.
Dimethylsuccin-β-naphthilic acid, i, 505.
Dimethylsuccin-*p*-tolil, i, 505.
Dimethylsuccin-*p*-tolilic acid, i, 505.
Dimethylterephthalic acid, i, 283.
2 : 3 : 5-Dimethylthienyl phenyl ketone, i, 509.
—— —— —— bromo-, and its oxime, i, 509.
Dimethylthiocarbamide, i, 577.
Dimethylthiocarbamine bisulphide, i, 577.
Dimethylthionuric acid, ammonium and barium salts of, i, 84.
Dimethylthiophen from coal tar, constitution of, i, 509.
2 : 3 : 5-Dimethylthiophencarboxylamide, i, 509.
2 : 3 : 5-Dimethylthiophencarboxylic acid, i, 509.
—— bromo-, i, 509.
Dimethylthiophens, i, 509.
2 : 5 : 4-Dimethyl-*p*-tolyldihydroglyoxaline, i, 567.
Dimethyltricarballylic acid, i, 478.
Dimethyluramil, i, 84.
aa-Dimethylurea, Trans., 563.
Dimethylvioluric acid, i, 84, 336, 337.
Dimorphous minerals, ii, 49.
ββ-Dinaphthadiquinone, Trans., 661.
Di-α-naphthalidocitric acid, i, 106.
Dinaphthoxanthone, i, 107.
α-Dinaphthoxyacetic acid, i, 44.
β-Dinaphthoxyacetic acid, i, 44.
ββ-Dinaphthyl, Trans., 656.
—— and its quinones, Trans., 653.
ββ-Dinaphthylcarboxylic acid, i, 293.
Dinaphthylenethiophen, i, 105.
Di-*iso*-nitraminebenzylic cyanide, i, 504.
Dinitrosoferroethyl mercaptide, ii, 451.
Dinitrosoferrophenyl mercaptide, ii, 452.
Dinitrososulphonic acid, salts of, ii, 75.
Diorcinolsulphophthaleïn, i, 184.
Diorcinylmethane, i, 46.
Diosma alba, occurrence of hesperidin in the leaves of, ii, 408.
Diospyros kaki, mannan as a reserve material in the seeds of, ii, 128.

Dioxythiazoleacetic acid, i, 13.
Diphenolbiuret, behaviour of, in the animal organism, ii, 280.
Diphenoxyacetic acid, i, 44.
—— —— dibromo-, i, 44.
Diphenoxymethane, Proc., **1895**, 40.
Diphenyl *p*-bromo-, i, 289.
—— conversion of isodiazohydroxides into derivatives of, i, 289.
—— *p*-nitro-, i, 289.
Diphenyl ketone, reduction of, by sodium ethoxide, i, 601.
Diphenylacetamidinecarboxylic acid, aniline salt of, i, 266.
Diphenacetonitrile, i, 585.
Diphenacylacetic acid and its reduction products, i, 666.
—— —— brominated bye-product formed in the preparation of, from bromacetophenone, i, 666.
Diphenylacetylenemethylureïn, i, 306.
Diphenylacetylene-β-naphthylureïn, i, 306.
Diphenylacetylenephenylureïn, i, 306.
Diphenylacetyleneureïn, i, 305.
Diphenylacetyltartaric acid, i, 267.
—— anhydride, i, 267.
Diphenylamide, thio-, preparation of, i, 132.
Diphenylamidineoxalanilide, i, 170.
Diphenylamine, 2 : 4-dinitro-, reduction of, i, 514.
—— oxidation of, by incomplete combustion, i, 272.
p-Diphenylamine, trinitro-, i, 514.
Diphenylamine-*n*-oxychlorophosphine, i, 363.
Diphenylamine-*n*-phosphinic acid, i, 364.
Diphenylaminepiperidine-*n*-phosphine oxide, i, 364.
αβ-Diphenylanilindole, i, 46.
Diphenylanthrone, i, 671.
iso-Diphenylbenzene, identity of, with *m*-diphenylbenzene, i, 149.
m-Diphenylbenzene, i, 149.
—— bromo-, i, 149.
—— tetrabromo-, i, 150.
p-Diphenylbenzene, *p*-bromo-, i, 150.
—— di-*p*-bromo-, i, 150.
—— tetrabromo-, i, 150.
Diphenylbenzenes, i, 149.
2′ : 3′ : 1′-Diphenylbenzyltetrahydroquinazoline, i, 134.
Diphenylbiuret, behaviour of, in the animal organism, ii, 280.
αγ-Diphenylbutyrolactone, i, 179.
Diphenylbuzylene, *p*-nitro-, i, 351.
Diphenyl-*iso*-carbamide, *p*-bromo-, i, 416.
m-Diphenylcarboxylic acid, bromo-, i, 149.
p-Diphenylcarboxylic acid, *p*-bromo-, i, 150.
αγ-Diphenylcrotolactone, i, 180.
βγ-Diphenylcrotolactone, Trans., 137.
Diphenyl-2 : 4-diazthiolid-5-on, 3-thio-, i, 579.
4 : 5-Diphenyldihydro-1 : 3-azoxole, 2-amido-, i, 596.
Diphenyldihydroisoxazole, i, 362.
Di-*p*-phenyldisazophenylene, Trans., 928.
Diphenylenediamine, *o*-amido-, oxidation product of, i, 528.
Diphenylenepyrodiazoline, amido-, i, 213.
Diphenylformazyl hydride, di-*m*- and di-*p*-nitro-, i, 575.
Diphenylglycollide, i, 526.
αβ-Diphenylglyoxaline μ-disulphide, i, 304.
—— μ-ethosulphide, i, 304.
—— μ-hydrosulphide, i, 304.
—— μ-methosulphide, i, 304.
—— μ-sulphonic acid, i, 304.
Diphenylhomofluorindine, i, 220.
Diphenyliodonium hydroxide, dichloro-, and its salts, i, 221.
—— —— iododichloro-; and its salts, i, 221.
Diphenylitaconic acid, i, 143.
Diphenylketipamidonitrile, i, 101.
Diphenylketipamidonitrilesulphonic acid, i, 101.
Diphenylketipodinitrile, i, 99.
3 : 5-Diphenyl-Δ_2-ketotetrahydrobenzene, i, 49.
Diphenylmethane, *o*-amido-, i, 52.
—— constitution of isomeric symmetrical di-derivatives of, i, 232.
—— 4 : 4′-diamido-, i, 232.
—— 2 : 4′-dinitro-, i, 232.
—— 4 : 4′-dinitro-, i, 232.
—— nitration of, i, 232.
—— *o*-nitro-, formation of acridine from, i, 476.
—— preparation of, Trans., 827.
—— tetranitro-, i, 232.
—— trinitro-, i, 232.
Diphenylmethane-*o*-azodihydroxybenzene, i, 53.
Diphenylmethane-*o*-azo-β-naphthol, i, 53.
Diphenylmethane-colouring-matters, i, 145.
Diphenylmethane-3 : 3-dicarboxylic acid, m. p. of, i, 148.
Diphenylmethanesulphone, *p*-diamido-, i, 54.
Diphenylmethylolid, i, 372.
αβ-Diphenyl-νβ-naphthylglyoxaline μ-ethosulphide, i, 305.
Diphenyloxanthranol chloride, i, 672.

1 : 5-Diphenyl-3-oxy-1 : 2 : 4-triazole, Trans., 1064; Proc., **1895**, 124.
—— synthesis of, Trans., 1063.
3 : 4-Diphenylpentamethylenecarboxylic acids, isomeric, i, 666.
αα′-Diphenylphenanthroline, i, 72.
αα′-Diphenylphenanthroline-γγ′-dicarboxylic acid, i, 72.
Diphenyl-*o*-phthalide, i, 290.
2 : 6-Diphenylpiperidine, i, 563.
Diphenylpiperidyl-*iso*-carbamide, i, 416.
—— *p*-bromo-, i, 416.
Diphenylpropionyltartaric anhydride, i, 268.
2 : 6-Diphenylpyridine, i, 563.
—— methiodide, i, 563.
Diphenylsulphone, derivatives of, i, 144, 471.
Diphenylsulphonediphenylcarbamide, i, 287.
Diphenyltetrahydroketotriazine, i, 460.
Diphenyltetrazolium chloride, i, 75.
Diphenyltetrazoliumcarboxylic acid, betaïne of, i, 74.
—— —— chloride of, i, 74.
Diphenylthiocarbamide, i, 461.
Diphenylthiohydantoïnacetic acid, i, 13.
2 : 4-Diphenylthiophen, i, 337.
2 : 5-Diphenylthiophen, i, 337.
Diphenylthiosemicarbazide, 2 : 4-dinitro-, i, 27.
αβ-Diphenyl-*p*-toluindole, i, 46.
Diphenyl-*p*-tolyltetrazolium chloride, i, 75.
1 : 5-Diphenyl-1 : 2 : 4-triazole, Trans., 1068; Proc., **1895**, 124.
—— hydrochloride, Trans., 1070.
—— platinochloride, Trans., 1070.
1 : 5-Diphenyl-1 : 2 : 4-triazolecarboxylic acid, Trans., 1069.
Diphthalyl, formation of, i, 376.
Dipiperidine, dithio-, i, 200.
Dipiperidinephosphineoxide, i, 430.
Dipiperidyl and its derivatives, i, 434.
Dipiperidylbutane, i, 681.
Dipiperidylpropane, i, 681.
Dipiperonyleneacetone, i, 469.
—— phenylhydrazone, i, 469.
Dipropargyl, magnetic rotation of, Trans., 258.
Dipropionitrile, i, 584.
Dipropionylbenzophenone, i, 422.
Dipropionylethylenediamine, i, 481.
Dipropionylilicene, i, 182.
Dipropionyl-4 : 1-methylethylglyoxalidine, 1, 482.
Dipropoxymethane, i, 14.
iso-Dipropyl, dinitro-, i, 633.
ab-Dipropylcarbamide, Trans., 563.
ab-Dipropylurea, Trans., 563.
Dipyridine cobaltous chloride, i, 121.
Dipyridine nickelous chloride, i, 122.
β-Dipyrogallolacetic acid, i, 367.
Diquinoline cobaltous chloride, i, 122.
Diquinolyl, hexabromo-, i, 566.
α-Diresorcinolacetic acid, i, 367.
β-Diresorcinolacetic acid, i, 367.
Diricinic acid, i, 82.
Di-*iso*-safrole, i, 24.
Disease, assimilation of lime in the body during, ii, 120.
—— human blood in, ii, 123.
Dispersion, atomic, of nitrogen, ii, 250.
—— of liquid oxygen, ii, 471.
—— of the CH_2-group, mean value for the, ii, 65.
—— rotatory, determination of, by the aid of ray filters, ii, 1.
Dispersive powers of nitrogen compounds, ii, 194.
Dissociation and heats of solution of sparingly soluble silver salts of fatty acids, ii, 435.
—— and optical rotation of active compounds, ii, 301.
—— electrolytic, ii, 36.
—— —— and optical rotation, relation between, ii, 301.
—— —— and osmotic pressure, cause of, ii, 308.
—— —— and temperature, relation between, ii, 203.
—— —— and the law of dilution in organic solvents, ii, 302.
—— —— of cyanides, ii, 478.
—— —— or ionic, hypothesis of, Trans., 1124.
—— new reaction illustrating the phenomena of, ii, 105.
—— of gold chloride, Trans., 881.
—— of liquid molecules, ii, 40.
—— of liquid nitric peroxide, influence of the solvent on the, Trans., 794.
Dissolution of solids in vapours, ii, 255.
Distillation, apparatus for reflux condensation or, ii, 260.
—— constant level apparatus for, ii, 162.
—— fractional, apparatus for, ii, 303, 387.
—— —— at very low pressures, ii, 215.
—— —— comparison of the methods for, ii, 304.
—— —— dephlegmator for, ii, 303, 304.
Dithiazolidine, i, 576.
αα-Dithienyl, i, 23.
Ditolazine, [1 : 3 : 4; 1 : 3 : 4 or 1 : 3 : 4; 1 : 4 : 5], i, 59.
Di-*p*-tolenylhydrazidine, i, 137.
Di-*p*-tolenylimidine, i, 138.
Di-*m*-toluhydroxamic acid, i, 39.
Di-*p*-toluhydroxamic acid, i, 39.

Di-*o*-toluidinediphenylamine-*n*-phosphine oxide, i, 364.
Di-*o*-toluidocitrazinamide, i, 157.
Di-*p*-toluoyltartaric anhydride, i, 268.
Ditolyl octohydride, i, 186.
Di-*p*-tolylamidineoxalo-*p*-toluidide, i, 170.
Di-*p*-tolylamine, *m*-amido-, i, 514.
—— *o*-amido-, oxidation of, i, 25.
—— nitro- and amido-derivatives of, i, 514.
Di-*p*-tolylbiazoxole, i, 138.
ab-o-p-Ditolylcarbamide, Trans., 562.
Di-*p*-tolyldihydrotetrazine, i, 138.
Di-*p*-tolyl-*iso*-dihydrotetrazine, i, 138.
Ditolylglycollide, i, 526.
Ditolylic acid, i, 526.
Di-*o*-tolyliodonium hydroxide and its salts, i, 529.
Di-*p*-tolyliodonium hydroxide and its salts, i, 221.
Ditolylmethane, diamido-, i, 148.
Di-*p*-tolylsulphonediphenylcarbamide, i, 288.
Di-*m*-tolylthiocarbamide, Trans., 559.
ab-o-p-Ditolylthiocarbamide, Trans., 558.
Di-*p*-tolyltetrazine, i, 138.
Di-*p*-tolyltriazole, i, 138.
ab-o-p-Ditolylurea, Trans., 562.
α-Di-*iso*-undecylthiocarbamide, i, 324.
Di-*iso*-valerylideneglutaric acid, i, 128.
—— —— dibromide, tetrabromide, and dihydrobromide, i, 128.
Dixylidocitrazinamide, i, 157.
Di-*o*-xylylsulphone, i, 287.
Di-*p*-xylylsulphone, i, 287.
Dodecairidious acid, potassium salt of, ii, 504.
Dog, ethylic sulphide in the urine of the, ii, 81.
—— loss of material in the, during inanition, ii, 78.
Dolomite, artificial, ii, 401.
—— formation of, ii, 50.
Drainage from cultivated land, ii, 138, 458.
Drops of molten metals, regularities in the weights of, ii, 161, 203.
Dropsical fluid, albumoses in, ii, 81.
Drying of hygroscopic substances, ii, 325.
Dufrenoysite from the Binnenthal, ii, 171.
Dulcin, i, 359.
Durene, amidonitro-, i, 345.
iso-Durene, derivatives of, i, 130.
—— dinitro-, i, 130.
—— oxidation of, i, 130.
—— oxidation products of, i, 283.
Durenecarboxylonitrile, nitro-, i, 345.
β-*iso*-Durylic acid, i, 130.
Dyeing properties of benzeneazomaclurin and its homologues, Trans., 936.
—— —— of jack-wood, Trans., 943.
—— theory of, ii, 39, 108, 135, 259, 668.
—— Liebermann's theory of, i, 108.
Dyes associated with corallin, i, 667.
—— formation of, from stereoisomeric diazo-compounds, i, 26.
—— phenolic, purification of, i, 667.

E.

Earth nut oil, detection of, ii, 540.
Earths, rare, history of, Trans., 470.
Ebullition, percussive, ii, 340.
Echidna, egg-shells of, ii, 54.
Egg-shells of *Echidna* and other vertebrates, ii, 54.
Electric potentials in a liquid conductor in uniform movement, ii, 197.
Electric, see also thermoelectric.
Electrical conductivity, ii, 252.
—— —— and convection in dilute solutions of small conductivity, ii, 252.
—— —— in aqueous solutions, ii, 252.
—— —— insufficient purity of the materials employed in the determination of, Trans., 1157.
—— —— near the critical temperature, ii, 377.
—— —— of acetic acid, influence of electrolytes on the, ii, 67.
—— —— of aqueous solutions of carbonic anhydride, ii, 100.
—— —— of organic salts, dependence of, on the temperature, ii, 4.
—— —— of permanganic acid, ii, 451.
—— —— of some ethereal salts of β-ketonic acids, i, 649.
—— oscillations, formation of ozone by the action of, ii, 109.
Electrocapillary phenomena, ii, 303.
Electrochemical phenomena of cellulose, Trans., 436, 449.
Electrochemistry, ii, 99.
Electrode, calomel, constancy of the, ii, 377.
Electrolysis of copper sulphate, ii, 4.
—— of gases, ii, 475.
—— of nitrosylsulphuric acid in sulphuric acid solution, ii, 10.
—— limits of, ii, 151.
—— Rudorff's process of, for analysis, ii, 139.
Electrolytes and metals, potential differences between, ii, 35.
—— determination of the resistance of, ii, 35.
—— influence of, on the conductivity of acetic acid, ii, 68.

Electrolytes, nature of, Trans., 1133.
—— thermoelectric phenomena between, ii, 152.
Electrolytic change and chemical change, unity of, Trans., 1139.
—— conductivity of rosaniline and related compounds, i, 540.
—— dissociation, ii, 36.
—— —— and optical rotation, relation between, ii, 301.
—— —— and osmotic pressure, cause of, ii, 308.
—— —— and temperature, relation between, ii, 203.
—— —— and the law of dilution in organic solvents, ii, 302.
—— —— hypothesis of, Trans., 1124.
—— —— of cyanides, ii, 478.
Electromotive efficiency of chemical change, Trans., 1147.
—— force of an iodine cell, Proc., **1895**, 30.
—— —— of the Clark cell when producing a current, ii, 34.
—— —— of the Clark, Gouy, and Daniell cells, ii, 475.
Element, new, from bauxite, ii, 313.
Elements, chemical, classification of, ii, 72, 310, 440, 491.
—— colour of, in relation to atomic weight, ii, 441.
—— melting points of, as a clue to their genesis, ii, 340.
—— periodic arrangement of, ii, 310, 440, 491.
—— principles of a new system of, ii, 72.
—— refraction equivalents of, and the periodic law, Proc., **1895**, 10.
—— rôle of atomic heat in the periodic series of the, ii, 198.
—— volume changes in, during melting, ii, 5.
Elements, galvanic. See Galvanic elements.
Elpidite from Greenland, ii, 401.
Emetine, i, 118.
Emoidin methyl ether, Trans., 1088.
Emulsin, action of, on glucosides, i, 7.
Entropy and the principle of maximum work, ii, 42.
Enzyme from yeast, i, 429.
—— of *Schizo-saccharomyces octosporus* and of *Saccharomyces Marxianus*, ii, 322.
Enzymes, action of, on glucosides, &c., i, 6.
—— influence of configuration on the action of, i, 6, 161, 441.
—— of yeast, i, 162, 429.
Eosin, constitution of, i, 234.
Epichlorhydrin, polymerides of, i, 408.
Epididymite from Greenland, ii, 23.
Epiethylin, i, 5.
Epithelium, ciliated, chemical stimulation of, ii, 80.
Equilibria, chemical, as temperature functions, ii, 211.
Equilibrium between liquid and solid phases, ii, 158.
Erythrocellulose, i, 166.
Erythrodextrin I, i, 492.
Erythrodextrin IIα, i, 492.
Erythrodextrin IIβ, i, 492.
Eschscholtzia californica, alkaloïds of, i, 689, 690.
Eseramine, i, 436.
Eseridine, i, 436.
Eserine-blue, i, 436.
Eseroline, i, 436.
Essence of Cananga, i, 425, 551.
—— of roots of Polygala, ii, 364.
—— of Ylang-ylang, i, 243.
Ethane, critical density of, ii, 379.
—— dinitro-, preparation of, i, 4.
—— liquid, i, 77.
—— physical constants of, i, 1, 122.
—— sodionitro-, i, 197.
Ethanetetracarboxylic acid, ethereal salts of, Trans., 768.
Ethenylphenyliodonium nitrate, dichlor-, i, 635.
Ethenylic trisulphide, i, 585.
Ethereal acidyltartrates, secondary, i, 210.
—— hydrogen sulphates in urine, ii, 55.
Ethereal oils. See Oils, Ethereal.
Ethereal salts, formation of, i, 499.
—— —— molecular surface energy of, ii, 40.
—— —— rate of hydrolysis of some, ii, 107.
Etherification and hydrolysis, i, 593.
—— influence of the substitution of halogens in acids, on the rate of, ii, 159.
—— of aromatic acids, i, 93, 228, 466.
—— —— —— —— the law of, i, 93.
—— velocity of. See Velocity of etherification.
Ethers, action of bromine on, in presence of sulphur, i, 317.
—— aromatic, action of phosphorus pentachloride on, i, 511.
Ethoxalyl-*o*-amidobenzaldehyde, i, 251.
o-Ethoxyacetophenone, i, 113.
Ethoxyallylmethoxyethoxybenzene, i, 657.
p-Ethoxyazobenzene, i, 353.
Ethoxybenzeneazoacetoacetic acid, i, 575.
o-Ethoxybenzoylacetone and its phenylimide, i, 113.
m-Ethoxybenzylideneamidoacetal, i, 624.

m-Ethoxycinnamic acid, i, 663.
Ethoxydimethyldiphenyl, diamido-, i, 27.
Ethoxydimethyldiphenylamine, amido-, i, 27.
2-Ethoxy-4 : 6-dimethylpyridine from the dry distillation of ethylic β amidocrotonate, Trans., 221.
Ethoxydiphenylquinoxaline, chloro-, i, 573.
4-Ethoxy-1 : 2-diphenyltriazine, i, 251.
2 : 2′-Ethoxyethyltetrahydro-*iso*-quinoline, i, 626.
Ethoxyformamidine, i, 12.
Ethoxymethylenecamphor, i, 64.
5 : 3-Ethoxymethyl-1-*p*-ethoxyphenylpyrazole, i, 398.
—— 4-nitro-, i, 398.
5 : 3-Ethoxymethyl-1-*p*-hydroxyphenylpyrazole, i, 398.
5 : 3 : 1-Ethoxymethylphenylpyrazole, i, 396.
Ethoxymethylphthalimide, i, 626.
Ethoxymethylsulphone, derivatives of, i, 85.
2 : 2′-Ethoxymethyltetrahydro-*iso*-quinoline, i, 626.
—— oxidation of, i, 626.
1-Ethoxynaphthalene, 4 : 2-iodonitro-, Trans., 913.
2-Ethoxynaphthalene, sulphonation of, Proc., **1895**, 49.
2 : 1 : 3′-Ethoxynaphthalenedisulphonamide, Proc., **1895**, 51.
2 : 1 : 3′-Ethoxynaphthalenedisulphonanilide, Proc., **1895**, 51.
2 : 1′ : 3′-Ethoxynaphthalenedisulphonic acid, Proc., **1895**, 51.
—— chloride, Proc., **1895**, 51.
2 : 3 : 3′-Ethoxynaphthalenedisulphonic chloride, Proc., **1895**, 52.
2 : 1-Ethoxynaphthalenesulphonamide, Proc., **1895**, 52.
2 : 1′-Ethoxynaphthalenesulphonamide, Proc., **1895**, 49.
—— nitro-, Proc., **1895**, 49.
2 : 2′-Ethoxynaphthalenesulphonamide, Proc., **1895**, 50.
2 : 3′-Ethoxynaphthalenesulphonamide, Proc., **1895**, 50.
—— 1-bromo-, Proc., **1895**, 50.
—— nitro-, Proc., **1895**, 50.
2 : 1-Ethoxynaphthalenesulphonanilide, Proc., **1895**, 52.
2 : 1′-Ethoxynaphthalenesulphonanilide, Proc., **1895**, 49.
2 : 2′-Ethoxynaphthalenesulphonanilide, Proc., **1895**, 50.
2 : 3′-Ethoxynaphthalenesulphonanilide, Proc., **1895**, 50.
2 : 1-Ethoxynaphthalenesulphonic acid, isomeric change of, into the 2 : 1′-acid, Proc., **1895**, 51.
2 : 1-Ethoxynaphthalenesulphonic chloride, Proc., **1895**, 51.
2 : 1′-Ethoxynaphthalenesulphonic acid, Proc., **1895**, 49.
—— —— nitro-, Proc., **1895**, 49.
—— chloride, Proc., **1895**, 49.
—— —— nitro-, Proc., **1895**, 49.
2 : 2′-Ethoxynapthalenesulphonic chloride, Proc., **1895**, 50.
2 : 3′-Ethoxynaphthalenesulphonic chloride, Proc., **1895**, 50.
—— —— 1-bromo-, Proc., **1895**, 50.
—— —— nitro-, Proc., **1895**, 50.
Ethoxy-α-naphthaquinone iodo-, i, 237.
Ethoxynicotinic acid, i, 244.
6-Ethoxyphenopyridazole, i, 303.
m-Ethoxyphenylcrotonic acid, i, 663.
Ethoxyphenylmaleïc acid, salts of, i, 103.
—— anhydride, i, 103.
Ethoxyphenylmaleïnamide, i, 103.
Ethoxyphenylmaleïnbenzoylimide, i, 103.
4′-*o*-Ethoxyphenylquinaldinesulphonic acid, i, 113.
5-Ethoxyphthalic acid, i, 626.
Ethoxy-*iso*-quinoline, i, 684.
2-Ethoxy-*iso*-quinoline, i, 625.
—— ethiodide, i, 625.
—— methiodide, i, 625.
Ethoxyquinoxaline, trichloro-, i, 511.
d-Ethoxysuccinic acid, Trans., 967.
l-Ethoxysuccinic acid, Trans., 967.
i-Ethoxysuccinic acid, resolution of, Trans., 960.
Ethoxysuccinic acids, active, ethereal salts of, Trans., 957.
Ethoxysulphonethylenesulphinic lactone, polymeric, i, 85.
2-Ethoxytetrahydro-*iso*-quinoline, i, 626.
Ethoxythiophosphazobenzene, i, 463.
Ethoxythiophosphazo-*p*-chlorobenzene, i, 463.
Ethoxythiophosphazo-*o*-toluene, i, 463.
Ethoxythiophosphazo-*p*-toluene, i, 463.
Ethoxythiophosphazotrimethylbenzene, i, 464.
Ethoxy-*p*-toluamide, i, 414.
ω-Ethoxy-*p*-toluic acid, i, 414.
Ethoxytoluquinonetoluidide, i, 27.
α-Ethylacetylacetone, i, 502.
Ethylamidocaffeïne, i, 116.
2-Ethylamido-4 : 5-diphenyldihydro-1 : 3-azothiole, i, 597.
2-Ethylamido-4 : 5-diphenyldihydro-1 : 3-azoxole, i, 597.
6 : 1 : 2 : 3 : 5-Ethylamidoethylketodihydropyridinecarboxylic acid, i, 559.
Ethylamine, action of, on benzile, Trans., 43.

Ethylamyl, rotatory power of, ii, 97.
Ethylanhydrodibenzileacetoacetic acid, Proc., **1895**, 147.
Ethylaniline-*p*-nitroso-, salts of, i, 598.
Ethylanishydroxamic acids, i, 38.
Ethylapoquinine, i, 436.
Ethylbenzene, sulphonation of, Proc., **1895**, 48.
Ethylbenzene-*o*-sulphonamide, Proc., **1895**, 48.
Ethylbenzene-*p*-sulphonamide, Proc., 1895, 48.
Ethylbenzene-*o*-sulphonic acid, Proc., **1895**, 48.
—— chloride, Proc., **1895**, 48.
Ethylbenzene-*p*-sulphonic acid, Proc., **1895**, 48.
—— chloride, Proc., **1895**, 48.
α-Ethylbenzhydroxamic acid, i, 38.
β-Ethylbenzhydroxamic acid, i, 38.
α-Ethylbenzhydroximepropionic acid, i, 125.
Ethylbenzoxime-*iso*-butyric acid, i, 522.
ab-Ethylbenzylcarbamide, Trans., 562.
ab-Ethylbenzylurea, Trans., 562.
Ethyl-*iso*-butylacetic acid, i, 499.
—— anilide, i, 500.
Ethyl-*iso*-butylbromacetic chloride, i, 500.
Ethyl-*iso*-carbanilide, i, 277.
Ethylcinchotenine, ethiodides and salts of, i, 403.
3-Ethyldiketotetrahydroquinazoline, i, 306.
ν-Ethyl-αβ-diphenylglyoxaline μ-hydrosulphide, i, 305.
—— μ-methosulphide, i, 305.
Ethyldiphenyloxamide, i, 218.
Ethyl-1 : 5-diphenyl-3-oxytriazole, Trans., 1064.
Ethyldithiourazole, i, 401.
—— nitroso-, i, 401.
Ethylemetonium hydroxide, i, 119.
—— iodide, i, 119.
Ethylene, behaviour of, with boron fluoride, i, 453.
—— incomplete combustion of, Proc., **1894**, 179.
Ethylenecatechol, i, 19.
—— nitro-, i, 19.
Ethylenechlorhydrin nitrite, i, 23.
Ethylenedianthranilic acid, i, 536.
—— —— synthesis of indigo from, i, 536.
Ethylenedicyanhydrin, i, 21.
—— diacetyl derivative of, i, 21.
—— dibenzoyl derivative of, i, 21.
α-Ethylenedihydroxylamine dihydrobromide, Trans., 1018.
Ethylenediphenyldisulphone, homologues of, i, 286.
Ethylenediquinol, i, 19.
Ethylenediquinol, acetyl, bromacetyl and ethyl derivatives of, i, 19.
Ethyleneditolyldisulphone, homologues of, i, 286.
Ethylenic acetonitrite, i, 23.
—— bromacetate, i, 19.
—— dibromosuccinate, i, 18.
—— diphenylmaleïnate, i, 18.
—— fumarate, i, 18.
—— glycol, action of chlorine on, i, 319.
—— —— phenylic ether of, Proc., **1895**, 40.
—— glycollate, i, 17.
—— isodibromosuccinate, i, 18.
—— maleïnate, i, 18.
—— oxalate, i, 17.
—— oxide, action of hydroxylamine on, Trans., 1019.
—— —— action of phenol on, i, 320.
—— —— action of phenylhydrazine on, i, 320.
—— —— action of piperidine and of pyridine on, i, 319.
—— —— polymerisation of, i, 320.
—— —— reactions of, i, 319.
—— succinate, preparation and constitution of, i, 18.
Ethylenemethylal, i, 266.
1-Ethyl-2-ethylimido-5-thio-3 : 4-dithiazolidine, i, 578.
Ethyleuxanthone, dibromo-, i, 554.
α-Ethyl-*d*-glucoside, i, 439.
Ethylglycollic acid, behaviour of the calcium salt of on dry distillation, i, 334.
Ethylglyoxalidine, i, 481.
Ethylhydroxydiphenylethylthiocarbamide, i, 597.
Ethylic acetate, molecular surface energy of, ii, 40.
—— acetoacetate, i, 501.
—— —— action of benzylamine on, i, 140.
—— —— action of diazomethane on, i, 494.
—— —— picrylhydrazone of, i, 28.
—— —— semicarbazide of, i, 251.
—— *iso*-acetone carbonate, i, 201.
—— acetonedicarboxylate, electrolysis of, i, 209.
—— β-acetoxy-α-benzoylcrotonate, i, 94.
—— β-acetoxyfumarate, i, 95.
—— β-acetoxy-*iso*-cinnamate, i, 94.
—— acetylcinchotenine, i, 483.
—— 3-acetyl-2 : 4-dimethyl-pyrroline-5-carboxylate, i, 68.
—— acetylenedicarboxylate, i, 510.
—— acetylglycollate phenylhydrazone, i, 502.
—— acetylmalate, rotatory power of, ii, 251.

Ethylic acetylmalonate, electrolysis of, i, 209.
—— acetylphenylpyrazolinedicarboxylate, i, 250.
—— acidyl tartrates, rotatory powers of, ii, 195.
—— aconitate, action of sodium on, i, 211.
—— alantolate, i, 555.
—— alcohol, action of magnesium and of iron on, i, 405.
—— —— action of, on nitrososulphates, Trans., 1101.
—— —— and water, freezing points of admixtures of, ii, 155, 156.
—— —— compounds of, with calcium and barium oxides, i, 259; ii, 341.
—— —— electrolysis of the vapour of, ii, 477.
—— —— estimation of, in so-called essential oils, ii, 141.
—— —— freezing points of solutions of, ii, 155, 156.
—— —— heat of vaporisation of, ii, 101.
—— —— molecular complexity of, ii, 41.
—— —— oxidation of, with Fehling's solution, i, 198.
—— —— reducing action of, at high temperatures, i, 538.
—— —— specific inductive capacity of, ii, 197.
—— allophanate, behaviour of, in the animal organism, ii, 280.
—— allylenetetracarboxylate, i, 129.
—— β-amidocrotonate, action of heat on, Trans., 215.
—— β-amido-*anti*-crotonate, i, 448.
—— amidocaproate, i, 446.
—— *p*-amidocinnamate, i, 365.
—— amidoethylenedicarboxylate, i, 20.
—— amidofumarate, i, 267.
—— *p*-amidophenylacetate, i, 602.
—— —— hydrochloride, i, 602.
—— *m*-amidosalicylate, i, 365.
—— *p*-amidotoluate, i, 365.
—— amylacetate, i, 203.
—— —— rotatory power of, ii, 149.
—— amylacetoacetate, i, 203.
—— —— rotatory power of, ii, 149.
—— amylic ether, b. p., sp. gr., and rotatory power of, i, 318.
—— amylmalonate, rotatory power of, ii, 149.
—— anhydrodibenzileacetoacetate, Proc., **1895**, 146.
—— anhydrohippurate, i, 284.
—— β-anilidobenzylmalonate, i, 470.
—— anilidoethylenedicarboxylate, i, 19.
—— —— anilide of, i, 20.
—— β-anilidofurfurylidenemalonate, i, 471.
Ethylic anisbenzhydroxamates, i, 40.
—— anishydroxamate, i, 38.
—— anthracene-β-sulphonate, i, 671.
—— anthraquinone-β-sulphonate, i, 671.
—— *iso*-atropate, i, 225.
—— azo-*m*-bromobenzenecyanacetate, i, 659.
—— azo-2 : 5-dibromobenzenecyanacetate, i, 660.
—— azo-α-naphthalenecyanacetate, i, 660.
—— azo-β-naphthalenecyanacetate, i, 660.
—— azo-2 : 4 : 6-tribromobenzenecyanacetate, .
—— benzaldehydo-*o*-oxamate, i, 251.
—— benzenesulphonate, hydrolysis of, i, 370.
—— α-benzenylamidoxime-*iso*-butyrate, i, 521.
—— benzhydroxamate, metallic derivatives of, i, 37.
—— benzoylacetate, action of acid anhydrides on, i, 95.
—— —— introduction of acid radicles into, i, 93.
—— *o*-benzoylbenzenesulphonate, i, 475.
—— α-benzoyl-β-benzoxycinnamate, i, 94.
—— benzoylcinchotenine, i, 483.
—— benzoylmalonate, i, 94.
—— —— electrolysis of, i, 209.
—— β-benzoyl-α-phenylpropionate, i, 361.
—— benzoylsarcolactate, Proc., **1895**, 54.
—— β-benzoxy-*iso*-cinnamate, i, 94.
—— benz-*p*-toluhydroxamates, i, 39, 40.
—— benzylamidocrotonate, i, 140.
—— benzylanishydroxamate, i, 38.
—— benzylglycollate, i, 331.
—— benzylideneacetylacetoneacetoacetate, i, 50.
—— benzylidenedibenzoylacetate, i, 48.
—— benzylidenedibenzoylpyruvate, i, 48.
—— benzylidenephenylhydrazidoacetate, i, 460.
—— *bis*-1 : 5-phenylpyrazolone-4-β-propionate, i, 395.
—— bromacetate, β-bromo-, i, 19.
—— α-bromacetoacetate, cause of the transformation of, into ethylic γ-bromacetoacetate, i, 81.
—— γ-bromethylisosuccinate, i, 171.
—— bromide, preparation of, i, 485.
—— *p*-bromobenzenesulphonate, hydrolysis of, i, 370.
—— α-bromodibenzoylacetate, i, 94.

Ethylic bromo-*m*-diphenylcarboxylate, i, 149.
—— *l*-bromomalate, i, 451.
—— bromomalonate, action of thiocarbamide on, i, 495.
—— 3 : 6-bromonitrophenyl-β-lactate, i, 283.
—— *o*-bromophenoxyacetate, i, 44.
—— *m*-bromophenylhydrazonecyanacetate, i, 659.
—— bromophenylmercapturate, i, 284.
—— α-bromopropionate, i, 16.
—— —— action of alkali nitrites on, i, 330.
—— *d*-bromopropionate, i, 451.
—— *l*-bromopropionate, Trans., 921.
—— *d*-bromosuccinate, i, 451.
—— *iso*-butylacetoacetate, i, 500.
—— *iso*-butylanhydrodibenzileacetoacetate, Proc., **1895**, 147.
—— butylcarbamate, i, 588.
—— *iso*-butylcarbamate, i, 588.
—— *sec*-butylcarbamate, i, 588.
—— *tert*-butylcarbamate, i, 588.
—— butylnitrocarbamate, i, 588.
—— *iso*-butylnitrocarbamate, i, 588.
—— *sec*-butylnitrocarbamate, i, 588.
—— *p*-*iso*-butylsalicylaldehydecarboxylate, i, 222.
—— caffeïnecarboxylate, i, 629.
—— campholate, i, 295.
—— *allo*-campholytate, Trans., 340.
—— —— dibromide, Trans., 340.
—— *allo*-camphothetate, Trans., 344.
—— carbethoxyisocinnamate, i, 95.
—— *m*-carboxyphenylhydrazonecyanacetate, i, 660.
—— chloracetate, action of phenylhydrazine on, i, 460.
—— *p*-chloraniline-*n*-phosphinate, i, 364.
—— chlorethylic succinate, i, 18.
—— *p*-chlorobenzenesulphonate, hydrolysis of, i, 370.
—— chlorodimethyl-*iso*-coumarilquinonic acid, i, 226.
—— chlorofumaramate, i, 267.
—— β-chloro-αα-keto-indenecarboxylic acid, i, 231.
—— *l*-chloromalate, i, 451.
—— *d*-chloropropionate, Trans., 918; i, 451.
—— *d*-chlorosuccinate, i, 450.
—— chloroximidoacetate, i, 448.
—— cincholeuponate, i, 484.
—— cinchonate, i, 70.
—— cinchotenine, i, 483.
—— cinnamoylthiocarbamate, Trans., 1049.
—— cinnamylidenediacetoacetate, i, 50.
—— citrate, action of sodium on, i, 211.
—— *iso*-citrate, i, 506.
Ethylic copper oxalacetate, i, 267.
—— cyanacetate, action of, on diazo-compounds, i, 659.
—— —— action of, on mononitrodiazobenzene salts, i, 274.
—— cyanacetoacetate, compound of, with phenylhydrazine, i, 648.
—— cyanide, α-dichlor-, solid, i, 161.
—— —— —— —— reduction of, i, 1.
—— —— trimolecular, chlor-, i, 161.
—— *iso*-cyanide, action of carbonyl chloride, ethylic chlorocarbonate, &c., on, i, 10.
—— —— molecular rearrangement in, i, 9.
—— cyanobutyrylacetate, compound of, with phenylhydrazine, i, 648.
—— cyano-*iso*-butyrylacetate, compound of, with phenylhydrazine, i, 648.
—— α-cyanopropionate, preparation of, Trans., 420.
—— cyanopropionylacetate, compound of, with phenylhydrazine, i, 648.
—— cyano-*iso*-valerylacetate, compound of, with phenylhydrazine, i, 649.
—— deoxybenzoïnbenzylideneacetoacetate, i, 49.
—— —— oxime of, i, 49.
—— diacetyl-3 : 5-diamidobenzoate, i, 531.
—— diacetylsuccinate, condensation of, with hydrazine hydrate, i, 247.
—— diacetyltartrate, i, 173.
—— 3 : 5-diamidobenzoate, i, 531.
—— diamylacetoacetate, rotatory power of, ii, 149.
—— diamylmalonate, rotatory power of, ii, 149.
—— dianishydroxamate, i, 40.
—— diazoacetate, action of, on unsaturated ethylic salts, i, 250.
—— —— action of picric acid on, i, 140.
—— dibenzoylacetate, i, 93.
—— dibenzoyltartrate, i, 268.
—— 2 : 5-dibromophenylhydrazonecyanacetate, i, 660.
—— $\alpha_1\alpha_2$-dibromopimelate, i, 338.
—— dibromosuberate, i, 338.
—— dibutyryltartrate, i, 174.
—— di-*iso*-butyryltartrate, i, 211.
—— dicaproyltartrate, i, 175.
—— dicarboxyglutaconate, i, 334.
—— —— action of aniline on, i, 560.
—— —— anilide, i, 561.
—— —— combination of, with guanidine, Trans., 1008.
—— —— hydrolysis of, i, 83.
—— *iso*-dichlorosuccinate, i, 19.
—— dicyanopropionate, Trans., 422.
—— di-*p*-ethoxydiphenylformazylformate, i, 574.

Ethylic di-*p*-ethoxydiphenyltetrazoliumcarboxylate chloride, i, 575.
—— digitoate, i, 66.
—— dihydrofluoranate, i, 291.
—— dihydrogen *h*-butanetetracarboxylate, i, 336.
—— dihydrogen dioxalosuccinate, i, 508.
—— —— —— phenylhydrazone of, i, 508.
—— dihydroxydimethylchlor-*iso*-coumarilic acid and its diacetyl, dibenzoyl, and quinoxaline derivatives, i, 226.
—— dihydroxypyridinedicarboxylate, i, 334.
—— dihydroxystearate, i, 501.
—— γφ-diketosebate, i, 334.
—— diketotetrahydropyridinedicarboxylate, action of aniline on, i, 561.
—— dimethylacrylate, condensation of, with ethylic malonate, i, 410.
—— *bis*-dimethylamidophenylacetate, i, 171.
—— dimethylisophthalodicyanacetate, i, 46.
—— 3 : 5-dimethyl-Δ_2-ketotetrahydrobenzene-4-carboxylate, i, 52.
—— 3 : 5-dimethyl-Δ_3-ketotetrahydrobenzene-6-carboxylate, i, 52.
—— 3 : 5-dimethyl-Δ_2-ketotetrahydrobenzene-4 : 6-dicarboxylate, i, 51.
—— 3 : 5 : 1-dimethylphenylpyrazole-4-carboxylate, i, 395, 396.
—— di-α-naphthoxyacetate, i, 44.
—— di-β-naphthoxyacetate, i, 44.
—— di-*m*-nitrodiphenylformazylformate, i, 575.
—— di-*m*-nitrodiphenyltetrazoliumcarboxylate, i, 575.
—— 2 - 4-dinitrophenylhydrazoacetate, i, 28.
—— dinitrosolactate, i, 330.
—— dinitroterephthalate, i, 180.
—— dioxalosuccinate, i, 506.
—— —— diphenylhydrazone, i, 507.
—— —— lactones of, i, 507.
—— dioxysuccinate, compound of, with phenylhydrazine, i, 172.
—— —— isomeric osazones of, i, 172.
—— —— osotetrazone, i, 173.
—— —— phenylhydrazone, i, 172.
—— diphenoxyacetate, i, 44.
—— diphenylacetyltartrate, i, 268.
—— diphenylamine-*n*-phosphinate, i, 364.
—— 3 : 5-diphenyl-Δ_2-ketotetrahydrobenzene-6-carboxylate, i, 48.
—— diphenyltetrazoliumcarboxylate chloride, i, 74.
—— diphenyltetrazonediacetate, i, 460.
—— dipropionyltartrate, i, 174.
Ethylic *m*-ditoluhydroxamate, i, 39.
—— *p*-ditoluhydroxamates, i, 39.
—— divaleryltartrate, i, 174.
—— di-*iso*-valeryltartrate, i, 211.
—— ethanetetracarboxylate, action of hydrazines on, i, 508.
—— ether, action of bromine on, in presence of sulphur, i, 317.
—— —— action of cyanogen chloride on, i, 257.
—— —— and methylic alcohol, osmotic phenomena between, with different diaphragms, ii, 487.
—— —— and boron fluoride, compound of, i, 452.
—— —— impurities in, i, 488.
—— —— lecture experiments on, ii, 73.
—— —— purification of, i, 259.
—— 6-ethoxycoumalin-3 : 5-dicarboxylate, action of aniline on, i, 560.
—— —— action of ethylamine on, i, 557.
—— β-ethoxycrotonate, action of bromine on, i, 502.
—— 6 : 1 : 2 : 3 : 5-ethoxyethylketocarboxydihydropyridinecarboxylate, i, 557.
—— ethoxymethylenemalonate, action of hydrazine hydrate on, Trans., 1008.
—— —— action of phenylhydrazine on, i, 193.
—— ethoxypropylenetetracarboxylate, i, 129.
—— *d*-ethoxysuccinate, Trans., 972.
—— 6 : 1 : 2 : 3 : 5-ethylamidoethylketocarboxydihydropyridinecarboxylate, i, 558.
—— ethylanhydrodibenzilacetoacetate, Proc., **1895**, 146.
—— ethyl-*iso*-butylacetate, i, 499.
—— ethyl-*iso*-butylbromacetate, i, 500.
—— 1 : 2 : 6 : 3 : 5-ethyldiketotetrahydropyridinedicarboxylate, i, 559.
—— ethylenediamidodiethylenetetracarboxylate, i, 334.
—— ethylenedianthranilate, i, 536.
—— ethylidenediacetoacetate, i, 51.
—— ethylidenequinaldinium-β-carboxylate, i, 112.
—— β-ethyl-*p*-tolu-*m*-diazine-α-carboxylate, i, 399.
—— ethyl-*p*-toluhydroxamate, i, 39.
—— formate, molecular surface energy of, ii, 40.
—— formylhydrazoneacetoacetate, i, 263.
—— formylphenylacetate phenylhydrazone, i, 366.
—— formylphenylacetates, isomerism of, i, 366.

Ethylic formylsuccinate, i, 127.
—— fumarate, action of sulphur on, i, 510.
—— —— chlor-, i, 18.
—— glycollate, preparation of, i, 331.
—— glycolylhydrazineacetoacetate, i, 332.
—— glyoxylate, phenylhydrazone, i, 461.
—— guaiacolglycollate, i, 45.
—— hemipinates, i, 421.
—— hexylcarbamate, i, 588.
—— hexylnitrocarbamate, i, 588.
—— hippurylglycollate, i, 331.
—— hydrazodimethylenedimalonate, Trans., 1010.
—— —— action of ammonia on, Trans., 1012.
—— —— action of hydrazine hydrate on, Trans., 1011.
—— hydrogen *iso*-atropate, i, 225.
—— —— benzoïnylmalonate, Trans., 133.
—— —— desylenemalonate, Trans., 134.
—— —— 3 : 5-dinitroterephthalate, i, 180.
—— —— diphenylitaconate, i, 143.
—— —— tetrahydronaphthalate, i, 57.
—— β-hydroxy-α-benzoylcinnamate, i, 93.
—— α-hydroxybutyrate, physical properties of, i, 410.
—— *m*-hydroxycoumarin-β-carboxylate, i, 419.
—— hydroxydimethyl-*iso*-coumarilate, i, 225.
—— —— acetyl, benzoyl, bromo-, and chloro-derivatives of, i, 226.
—— 2 : 6-hydroxydiphenylcarboxylate, i, 373.
—— hydroxyethylic succinate, i, 18.
—— 6 : 1 : 2 : 3 : 5-hydroxyethylketocarboxydihydropyridinecarboxylate, i, 558.
—— 6 : 1 : 2 : 3 : 5-hydroxyethylketodihydropyridinedicarboxylate, i, 559.
—— hydroxyfurfuryl-*m*-diazineacetate, i, 266.
—— hydroxy-β-naphthyl-*m*-diazineacetate, i, 266.
—— hydroxyphenylamidopropionate, i, 446.
—— hydroxyphenyl-*m*-diazineacetate, i, 266.
—— *m*-hydroxyphenylhydrazonecyanacetate, i, 661.
—— *o*-hydroxyphenylhydrazonecyanacetate, i, 661.
—— *p*-hydroxyphenylhydrazonecyanacetate, i, 661.
—— 6 : 1 : 2 : 3 : 5-hydroxyphenylketodihydropyridinedicarboxylate, i, 560.
Ethylic *m*-hydroxystilbenecarboxylate, i, 663.
—— hydroxy-*p*-tolyl-*m*-diazineacetate, i, 266.
—— imidomalonate hydrochloride, i, 266.
—— iodide and methylic sulphide, velocity of reaction between, ii, 8.
—— *p*-iodobenzenesulphonate and its hydrolysis, i, 370.
—— *p*-iodophenylmercapturate, i, 605.
—— ketipate osazone, action of acetic acid on, i, 173.
—— ketohydroxystearate, i, 82.
—— *d*-lactate, Trans., 917.
—— malate, rotatory power of, ii, 251.
—— malonamate, i, 266.
—— malonate, action of nitric oxide on i, 503.
—— —— condensation of acetone with, i, 334, 410.
—— —— condensation of benzile with, Trans., 132.
—— —— condensation of ethylic 1 : 1-trimethylenedicarboxylate with, Trans., 108, 111.
—— —— oxidation and electrolysis of, i, 208.
—— mercuridiazoacetate, i, 203.
—— methanetricarboxylate, oxidation and electrolysis of, i, 208.
—— β-methoxycrotonate (? *trans*), i, 494.
—— 3-methoxy-2′-phenylcinchoninate, i, 115.
—— *l*-methoxysuccinate, Trans., 971.
—— β-methyladipate, i, 448.
—— methylamidoethylenedicarboxylate, i, 334.
—— α-methyl-μ-amidothiazole-β-acetate, i, 496.
—— methylanishydroxamate, i, 39.
—— methylbutanetetracarboxylate, formation of, Trans., 114.
—— methyl-*iso*-butylacetate, Trans., 511.
—— α-methylbutyrolactonecarboxylate, i, 171.
—— methylenediacetoacetate, i, 51.
—— methylenedibenzoylacetate, i, 48.
—— ββ-methylethylpropionate, Trans., 267.
—— methylmalonate, condensation of ethylic 1 : 1-trimethylenedicarboxylate with, Trans., 114.
—— α-methyl-γ-phenoxyethylmalonate, Proc., **1895**, 40.
—— methylphenylmalonate, i, 368.
—— 3 : 5-methylphenyl-Δ_2-keto-

tetrahydrobenzene-4 : 6-dicarboxylate, oxime of, i, 50.
Ethylic methylphenylpyrazolonecarboxylate, constitution of, i, 432.
—— 3 : 1-methylphenyl-5-pyrazolonecarboxylate, i, 570.
—— 3 : 4-methylpyrazoloneacetate, i, 247.
—— 3-methylpyrazolone-1-carbonyl-β-amidocrotonate, i, 252.
—— 3 : 5-methylstyryl-Δ_2-ketotetrahydrobenzene-4 : 6-dicarboxylate, i, 51.
—— β-methyl-*p*-toluo-*m*-diazine-α-carboxylate, i, 399.
—— methyltriphenyldihydropyridinecarboxylate, i, 50.
—— methylvinaconate, i, 172.
—— α-naphthylhydrazonecyanacetate, i, 660.
—— β-naphthylhydrazonecyanacetate, i, 660.
—— nicotinate, i, 391.
—— —— ethiodide, i, 391.
—— 3 : 5-nitramidobenzoate, i, 365.
—— *iso*-nitramineacetoacetate, i, 502.
—— *m*-nitrobenzeneazobenzoylcyanacetate, i, 275.
—— (α) *m*-nitrobenzeneazocyanacetate, i, 274.
—— (β) *m*-nitrobenzeneazocyanacetate, i, 274.
—— (α) *o*-nitrobenzeneazocyanacetate, i, 275.
—— (β) *o*-nitrobenzeneazocyanacetate, i, 275.
—— (β) *p*-nitrobenzeneazocyanacetate, i, 275.
—— (α) *p*-nitrobenzeneazocyanacetate, i, 275.
—— *m*-nitrobenzeneazoethylcyanacetate, i, 275.
—— *m*-nitrobenzoylhydrazoacetoacetate, i, 276.
—— *o*-nitrobenzoylhydrazoacetoacetate, i, 276.
—— *p*-nitrobenzoylhydrazoacetoacetate, i, 276.
—— nitrofurfurylcyanacrylate, i, 651.
—— nitrofurfurylidenemalonate, i, 652.
—— 4 : 1-nitronaphthoic acid, i, 670.
—— *p*-nitrophenylbenzoic acid, i, 290.
—— *iso*-nitrosoacetoacetate, oxidation of, with nitric acid, i, 447.
—— α-nitrosobutyrate, i, 331.
—— nitrosophenylamidoacetate, i, 459.
—— nitrosopropionate, i, 169.
—— 3 : 5-nitrothionylamidobenzoate, i, 365.
—— oxalacetate, action of ammonia on, i, 335.
—— oxalate, m. p. of, i, 450.
—— oxalosuccinate, i, 506.
Ethylic oxalylglycollate, i, 331.
—— oximidonitroacetate, i, 447.
—— pentacetylgalactonate, i, 504.
—— γ-phenoxydipropylmalonate, i, 480.
—— phenylazocarboxylate, i, 604.
—— *d*-phenylbromacetate, i, 451.
—— phenylcarbazinate, i, 604.
—— *d*-phenylchloracetate, i, 451.
—— 1 : 2 : 6 : 3 : 5-phenyldiketotetrahydropyridinedicarboxylate, i, 560.
—— *m*-phenylenediamidodiethylenetetracarboxylate, i, 334.
—— phenylhydrazidoacetate, asymmetrical, i, 459.
—— —— action of phenylthiocarbimide on, i, 460.
—— —— symmetrical, i, 461.
—— β-phenylhydrazidobenzylmalonate, i, 470.
—— phenylic ether, brom-, Proc., 1895, 40.
—— —— —— chlor-, Proc., 1895, 40.
—— phenylimidobromoformate, i, 277.
—— phenylimidocarbanilate, i, 278.
—— phenylmalonate, syntheses by means of, i, 368.
—— 3-phenylpyridazinone-5-carboxylate, i, 248.
—— β-phenyl-*p*-toluo-*m*-diazine-α-carboxylate, i, 400.
—— *iso*-phthalodicyanate, i, 45.
—— phthalylhydrazideacetate, i, 355.
—— piperonylenemalonate, i, 469.
—— potassium amidofumarate, i, 267.
—— —— camphorate (allo), electrolysis of, Trans., 337.
—— —— sulphobenzenexanthate, Proc., 1895, 141.
—— —— sulphohydrazimethylenecarboxylate, i, 642.
—— propionate, molecular surface energy of, ii, 40.
—— *iso*-propylenemalonate, i, 334.
—— pyrazolonecarboxylate, constitution of, Trans., 1009, 1013.
—— *iso*-pyrazolonecarboxylate, constitution of, i, 432.
—— pyruvate, action of hydroxylamine on, i, 394.
—— —— benzoylhydrazone of, i, 35.
—— quinaldine-β-carboxylate and its alkyl haloïd derivatives, i, 112.
—— sarcolactate, Proc., 1895, 54.
—— selenide, ethylic and methylic platinochlorides of, i, 8.
—— succinate and ketones, synthesis of unsaturated dicarboxylic acids from, i, 142.
—— —— chlor-, i, 18.
—— *iso*-succinate, action of, on ethylenic bromide, i, 171.

Ethylic succinyldi-β-thiocarbamate, Trans., 571.
—— succinylglycollate, i, 331.
—— sulphide in dog's urine, ii, 81.
—— —— platinum compounds of, i, 488.
—— sulphophenylhydrazonecyanacetate, i, 661.
—— tetramethyldiamidodiphenylacetate, i, 171.
—— thiohydantoïncarboxylate, i, 495.
—— *m*-thionylamidoanisate, i, 365.
—— *p*-thionylamidocinnamate, i, 365.
—— *p*-thionylamidotoluate, i, 365.
—— thiophentetracarboxylate, i, 510.
—— thiosulphate, i, 258.
—— 3 : 4 : 5-tribromobenzoate, Trans., 596.
—— 2 : 4 : 6-tribromophenylhydrazonecyanacetate, i, 660.
—— trimethylbenzodifurfuranedicarboxylate, i, 226.
—— trimethylcyanosuccinate, Trans., 422.
—— trimethylenedicarboxylate, i, 172.
—— 1 : 1-trimethylenedicarboxylate, condensation of, with ethylic malonate, Trans., 108, 111.
—— —— condensation of, with ethylic methylmalonate, Trans., 114.
—— 2 : 4 : 6-trinitrobenzoate, Trans., 600.
—— trinitrophenylglycollate, i, 140.
—— 3 : 4 : 5-triphenyl-Δ_2-ketotetrahydrobenzene-6-carboxylate, i, 49.
—— 2 : 4 : 6-triphenylpyridine-3 : 5-dicarboxylate, i, 48.
—— *p*-tolubenzhydroxamates, i, 39, 40.
—— *p*-toluhydroxamate, i, 38.
—— β-*o*-toluidobenzylmalonate, i, 471.
—— β-*p*-toluidobenzylmalonate, i, 471.
—— β-*m*-tolyl-αγ-diketohydrindeneacetate, i, 536.
—— undecolate, i, 447.
—— valerylthiocarbamate, Trans., 1045.
—— vulpate, i, 101.
Ethylidenediantipyrine, i, 482.
Ethylidenediphenylsulphone, i, 422.
Ethylidenepicrylhydrazine, i, 28.
Ethylidenepropionic acid, i, 131.
—— —— action of bromine and hydrogen bromide on, i, 205.
—— —— intramolecular change in, i, 204.
Ethylidenetetramethyldi-*m*-amidophenol, i, 47, 147.
Ethylimidocarbonyl chloride, i, 9.
Ethylimidoethylthiourazole, i, 402.
—— nitroso-, i, 402.
Ethylimidopyruvic chloride, i, 10.
—— phenylhydrazone, i, 9.
Ethylimidothioformic acid, i, 9.
3-Ethylketotetrahydroquinazoline, i, 306.
Ethylkynurine, i, 70.
Ethyllactonitrile, i, 257.
Ethylmethylsulphone, chlor-, i, 85.
Ethylmethylvaleric acid, i, 499.
Ethylnaphthalimide, i, 239.
Ethylnaphthaloxime, i, 240.
1″-Ethyl-β-naphthindole, i, 145.
1″-Ethyl-β-naphthindolesulphonic acid, salts of, i, 145.
Ethylnitrolic acid, action of hydrogen chloride on, i, 456.
—— —— benzenesulphonic ether of, i, 456.
β-Ethylpheno-*m*-diazine, i, 250.
Ethyl-*o*-phenolbenzylamine, i, 537.
Ethylphenonaphthacridine, i, 107.
μ-Ethylphenopentoxazole, i, 191.
1-Ethylphenopyridazolone, i, 302.
Ethylphenylamido-*p*-tolylbenzenylamidine, i, 347.
ab-Ethylphenylcarbamide, Trans., 564.
Ethylphenyldihydronaphthimidazole, i, 58.
Ethyl-*cyclo*-phenylenebenzylidene oxide, i, 537.
Ethylphenyliodonium chloride, dichlor-, i, 635.
—— iodide, dichlor-, i, 635.
—— nitrate, dichlor-, i, 635.
α-Ethyl-β-phenylnaphthylenethiocarbamide, i, 58.
Ethylphenylnitrosamine, i, 598.
1 : 3-Ethylphenylphenopyridazolone, i, 303.
3 : 1-Ethylphenyl-5-pyrazolone, derivatives of the phenol form of, i, 396, 571.
Ethylphenylthiocarbamide, i, 218.
Ethylphenylthiocarbimide, i, 218.
ab-Ethylphenylurea, Trans., 564.
Ethylphthalazone, i, 569.
α-Ethylpiperic acid, i, 468.
Ethylpiperine, i, 469.
Ethylquinol, i, 412.
Ethylquinone, i, 412.
Ethylresacetophenone, i, 43.
Ethylsulphidebromoplatosothioethylic chloride, i, 489.
Ethylsulphideplatosothioethylic chloride, i, 488.
Ethythiobenzenesulphonic acid, potassium salt of, Proc., **1895**, 141.
Ethylthiocarbimide, action of bromine on, i, 578.
Ethyl-*m*-toluhydroxamic acid, i, 538.
Ethyl-*p*-toluhydroxamic acids, i, 38.
Ethyl-*o*-toluidine, action of diazotised *p*-nitro-*o*-toluidine on, Trans., 249.
—— derivatives of, Trans., 246.
—— *p*-nitro-, i, 247.

Ethyl-*o*-toluidine, *p*-nitro-, action of diazotised *m*-nitraniline on, TRANS., 250.
—— —— action of diazotised *p*-nitro-*o*-toluidine on, TRANS., 250.
—— —— action of diazotised *o*-toluidine on, TRANS., 249.
—— —— bromo-, i, 248.
—— —— nitroso-, i, 248.
β-Ethyl-*p*-tolu-*m*-diazine i, 400.
β-Ethyl-*p*-tolu-*m*-diazine-*α*-carboxylic acid, i, 399.
Ethyl-*p*-tolylamidophenylbenzenylimidine, i, 347.
1″-Ethyl-3″-*p*-tolyldihydronaphthimidazole, i, 58.
Ethyl-*β*-*n*-tolyl-*αγ*-diketohydrindene, i, 536.
1 : 2 : 4-Ethyltolylenediamine, TRANS., 247.
Ethyl-*p*-tolyliodinium chloride, dichlor-, i, 635.
Ethyl-*p*-tolyl-1 : 2-naphthylenediamine, i, 58.
Ethyltriacetonamine, i, 328.
Ethyltripiperidine-*n*-phosphonium iodide, i, 682.
d-Eucalyptene, i, 673.
i-Eucalyptene, i, 674.
Euchroite from Liebethen, Hungary, ii, 507.
Eugenol acetate, tribrom-, i, 656.
—— derivatives, i, 603, 656.
—— dibromide, tribrom-, i, 656.
—— ethyl ether, dibrom-, i, 656.
—— methyl ether, brom-, i, 656.
—— —— —— dibromide, brom-, i, 656.
—— —— —— —— dibrom-, i, 656.
iso-Eugenol dibromide, i, 657.
—— —— brom-, 657.
—— ethyl ether dibromide, i, 657.
Eugenolacetic acid, salts of, i, 603.
iso-Eugenolacetic acid, i, 603.
Evernia pinastri (? *prunastri*), acid from, i, 299.
Evodia meliæfolia, colouring principle of, TRANS., 413, 414.
Excreta, test for in water, ii, 332.
Expansion, thermal of aqueous solutions, ii, 339.
Explosive mixture, a new, ii, 9.
Explosives, modern, ii, 434.
Extraction apparatus, ii, 43.
—— —— modification of Soxhlet's, ii, 411,
—— —— modification of Tollen's, ii, 374.

F.

Fat, absorption of, in the animal organism, ii, 320.
Fat and carbohydrates, relation of to the decomposition of albumin in the human body, ii, 404.
—— estimation of, in animal organs, ii, 540.
—— estimation of, in milk, ii, 298, 299, 373, 539.
—— estimation of, in milk, centrifugally, ii, 539.
—— estimation of, in milk by Soxhlet's method, ii, 95.
—— extraction apparatus, modification of Soxhlet's, ii, 411.
—— extraction apparatus, modification of Tollen's, ii, 374.
—— in milk, demonstration of, ii, 122.
—— influence of, on metabolism, ii, 516.
—— influence of, on the assimilation of proteïds, ii, 78.
—— of maize meal, i, 501.
Fats, "drying" of, i, 446.
—— estimation, gravimetric, of the bromine absorption of, ii, 428.
—— estimation of small quantities of chlorine in, ii, 85.
—— Hübl's iodine absorption method for, ii, 428.
Feeding with grain, ii, 453.
Feeding-stuffs, estimation of nitrogen in by Kjeldahl's method, ii, 243.
Felspar from Litchfield, Maine, ii, 511.
Fenchenole, i, 381.
Fenchocarboxylic acid, i, 381.
Fencholenamide, i, 381.
iso-Fencholenic alcohol, i, 381.
Fenchone, i, 380.
—— constitution of, i, 382, 428, 675.
α-*iso*-Fenchonoxime, i, 381.
Fenchylic alcohol and its isomeride, i, 381.
Fergusonite from Ceylon, ii, 22.
—— helium from, TRANS., 689.
Ferment, glycolytic, ii, 277.
—— nitrifying, ii, 83.
Ferment-actions of saliva, pancreatic juice, intestinal juice, and blood on starch, comparison of, ii, 403.
Fermentation, albuminous, ii, 283.
—— alcoholic, ii, 282.
—— —— effect of oxygen on, ii, 282.
—— hypothesis as to hydrolysis in, TRANS., 1136.
—— pancreatic, the leucine of the, ii, 25.
—— of polysaccharides by *Saccharomycetes*, ii, 322.
—— pectic, i, 312.
Ferments, gastric, action of thiocyanic acid on, ii, 403.
Ferratin, i, 196.
—— and iron in the liver, ii, 173.
Ferrialbuminic acid, i, 196.

Ferric acetate, action of, on potassium iodide and hydrogen iodide, ii, 111.
—— ammonium bromide, ii, 165.
—— —— chloride, ii, 165.
—— —— chromate, ii, 227.
—— cæsium bromides, ii, 165.
—— —— chlorides, ii, 165.
—— chloride, absorption spectra of dilute solutions of, ii, 434.
—— —— action of nitric oxide on, ii, 495.
—— —— action of, on metallic iodides, ii, 395.
—— —— and hydrogen sulphide, action of, in the gaseous state, ii, 225.
—— —— and stannous chloride, velocity of reaction between, ii, 257.
—— —— compound of nitric oxide with, ii, 271.
—— —— hydrated hydrochlorides of, ii, 159.
—— —— molecular refraction of dissolved, Trans., 836, 844.
—— —— solubility isothermals for, ii, 158.
—— oxide, free, estimation of, in soil, ii, 293.
—— —— heat of formation of, ii, 305.
—— potasssium chloride, ii, 165.
—— —— chromates, ii, 227.
—— rubidium bromide, ii, 165.
—— —— chloride, ii, 165.
—— salts, reduction of, with zinc, prior to titration, ii, 291.
—— sulphate, action of potassium iodide and hydriodic acid on, ii, 17.
—— —— basic, from Parys Mount, Anglesey, ii, 506.
—— thiocyanate, behaviour of, in solution, i, 77.
Ferrocyanides, i, 486.
Ferromanganese, estimation, volumetric, of manganese in, Trans., 274.
—— occurrence of titanium cyanonitride in, i, 487.
Ferrous carbonate, heat of formation of, ii, 306.
—— chloride, compounds of, with nitric oxide, ii, 496.
—— —— hydrates of, ii, 226, 269.
—— manganicyanide, i, 486.
—— oxide, heat of formation of, ii, 305.
—— silicate, heat of formation of, ii, 306.
—— titanoantimonate from Brazil, ii, 508.
Fertilisers, estimation of total nitrogen in, ii, 328.
Fibre, woody, estimation of, in fodders, ii, 189.
Fibrin and fibrinogen, ii, 234.
—— colour reactions for, ii, 376.
—— estimation of, in blood, ii, 300.
Fibrin-ferment, nature of, ii, 518.
Fibrinogen and fibrin, ii, 234.
—— coagulation of, ii, 235.
Fibrinolysis, ii, 300.
Filicic acid, i, 68.
Filter pumps, safety valve for, ii, 346.
Filtering, substitute for a funnel in, ii, 162.
Filters, nitrocellucose, ii, 325.
Fisetin hydrobromide, Trans., 649.
—— hydrochloride, Trans., 649.
—— hydriodide, Trans., 649.
—— sulphate, Trans., 648.
Flame, coal-gas, structure of, and chemistry of the non-luminous, Trans., 1051, Proc., **1895**, 72.
—— composition of atmospheres which extinguish, ii, 443.
—— of acetylene, Trans., 1059.
—— spectra at high temperatures, ii, 432.
—— temperature gradients of, Trans., 1050.
—— temperatures, Trans., 1049.
Flames, alleged liberation of carbon from cyanogen in, Trans., 1061.
—— chemistry of, ii, 478.
—— composition of the extinctive atmospheres produced by, ii, 494.
—— hydrocarbon, luminous, acetylene theory of, Trans., 1049.
—— —— —— structure of, Trans., 1054.
—— —— —— temperatures of different parts of, Trans., 1053.
—— —— non-luminous, measurement of the temperature of, Trans., 1051.
—— occurrence of acetylene in, Trans., 1057.
—— structure of, ii, 478.
—— temperatures of different parts of, Trans., 1050.
Fluoran, action of alkalis on, i, 291.
Fluorenone, *o*-amido-, i, 372.
Fluoresceïn colouring matters, i, 46.
—— constitution of, i, 182, 183, 234, 291, 538.
—— diethyl ether, i, 183.
—— dimethyl ether, i, 55, 291.
—— ethers, i, 291.
—— ethyl ether, i, 183.
—— —— —— acetyl derivative of, i, 183.
—— —— —— bromo-, i, 183.
—— ethylic salt of, i, 183.
—— methyl ether, i, 291.
—— —— —— anilide of, i, 291.
iso-Fluoresceïn diethyl ether, i, 55.
Fluoresceïnanilide diethyl ether, i, 55.
—— dimethyl ether, i, 55.
Fluoresceïnanilides, i, 55.
Fluorescin triethyl ether, i, 183.
Fluorime, i, 46.

Fluorindine, synthesis of, i, 220.
Fluorindines, i, 148, 220, 447, 526.
—— constitution of, i, 148, 526.
Fluorine, estimation of, i, 453; ii, 327, 460.
—— estimation of, in organic boron compounds, i, 453.
—— estimation, volumetric of, in soluble fluorides, ii, 327.
Fluorone, i, 46.
Fodder, acid, and its effect on the organism, ii, 517.
Fodders, estimation of woody fibre in, ii, 189.
Folia bucco, occurrence of hesperidin in, ii, 408.
Food, effect of the addition of calcium phosphate to, ii, 121.
—— influence of the division of, into rations on metabolism, ii, 78.
—— Kuhn's method of artificial digestion of nitrogenous constituents of, by pepsin solution, ii, 516.
Foods, Kjeldahl's method of estimating nitrogen in, ii, 528.
Formaldehyde, action of ammonium salts on, i, 326.
—— action of halogen hydracids on, in presence of alcohols, i, 80.
—— action of hydroxylamine and methylamine hydrochlorides on, i, 325.
—— action of methylamine and ammonia on, i, 325.
—— action of nitromethane on, i, 638.
—— action of, on amines, i, 641.
—— as a preservative for milk, ii, 373.
—— carbohydrates prepared from, i, 444.
—— condensation of, with alcohols of the fatty series in presence of hydrochloric acid, i, 14.
—— condensation of, with ammonia, i, 642.
—— condensations with, i, 14, 148, 642.
—— detection of, in milk, ii, 373.
—— gaseous, production of, for disinfecting purposes, i, 167.
—— lamp for the production of, ii, 161.
Formaldehydehydroxyfluorone, i, 46.
Formaldehydehydroxytolufluorone, i, 47.
Formaldehydetetramethylamidofluorimium chloride, i, 47.
Formalin, detection of, ii, 426.
Formamide, heat of formation of, ii, 483.
Formanilide, bromo-, i, 277.
—— heat of formation of, ii, 483.
Formazyl compounds, i, 573.
—— —— formation of, i, 74.
Formhydrazide, i, 263.
Formic acid, action of thionyl chloride on, ii, 44.
—— —— affinity constants of, ii, 253.
—— —— estimation of, by potassium permanganate, ii, 463.
Formodiphenylamidine, chloro-, action of sodium ethoxide on, i, 277.
Formose, non-identity of, with methylenitan, i, 165.
Formoxime, chloro-, i, 10, 81.
Formyl derivatives of aromatic amines, preparation of, Trans., 829.
αβ-Formylacetylphenylhydrazine, i, 354.
Formyl-*o*-amidobenzylic sulphide, i, 191.
Formylanilido-*n*-phenylmethenylphenylenediamine, i, 600.
Formylbenzoylcarbamide, i, 218.
Formylbenzylamine, i, 457.
"Formyl-*p*-benzylenimide," i, 523.
Formylcarbamide, metallic derivatives of, i, 269.
Formylmesidide, i, 357.
—— dimolecular, i, 357.
—— —— chloride, i, 357.
—— polymolecular, i, 357.
Formylphenylacetic phenylhydrazide, i, 366.
Formylphenyl-*μ*-amidophenylinduline, i, 608.
Formyl-*o*-tolylhydrazide, Trans., 830.
Freezing of sulphuric acid solutions, ii, 106.
Freezing point, depression of, by aldoximes, i, 657.
—— —— depression of, by alkali aluminates and borates, ii, 156.
—— —— depression of, in certain solutions, ii, 7.
—— —— depression of, in dilute solutions of sodium chloride, ii, 206.
—— —— depressions in dilute alcoholic solution, ii, 41.
—— —— of liquid mixtures, ii, 204.
—— —— of mixtures, maximum depression of, ii, 205.
—— —— of very dilute solutions, a new method of determining, Trans., 1.
—— —— of water, determination of, ii, 105.
—— —— See also Cryoscopy.
Freezing points of acetic acid and its chloro-derivatives, Trans., 669, 679.
—— —— of admixtures of ethylic alcohol and water, ii, 155.
—— —— of calcium chloride solutions, ii, 208.
—— —— of cane sugar solutions, ii, 343.
—— —— of concentrated solutior ii, 71.
—— —— of dilute solutions, ii, 155.

Freezing points of gold and silver, TRANS., 1024.
—— —— of isomorphous mixtures, ii, 206.
—— —— of metals, TRANS., 185.
—— —— of salts, TRANS., 190.
—— —— of solutions of the metallic salts of active lactic acids, TRANS., 632.
—— —— of some carbon compounds, i, 272.
—— —— of some organic liquids, ii, 206.
Frigotherapy, ii, 123.
Fructosediacetone, i, 440.
β-Fructosediacetone, i, 440.
Fruits, green, occurrence of glyoxylic acid in, ii, 409.
Fulminic acid, constitution of, i, 10.
Fumarates, amido-, i, 267.
Fumaric acid, m. p. of, ii, 379.
Fumarine, i, 689.
Fungi, cell-membrane of, and the presence of chitin therein, i, 80, 124, 166, 199, 323; ii, 323, 408.
—— trichophytic, digestion of horny tissue by, ii, 457.
—— two carbohydrates from, i, 323.
Fungus-cellulose. See Fungi, cell membrane of.
Funnel, separating, simple substitute for, ii, 162.
—— substitute for, in filtering, ii, 162.
Furazan, derivatives of, i, 192.
Furazandicarboxylic acid, i, 192.
Furazanic compound from diisonitroso-*iso*-methyleugenol peroxide, i, 36.
allo-Furfuracrylic acid, molecular change in, on exposure to sunlight, i, 454.
Furfuraldehyde, estimation of, ii, 143.
—— estimation of, in pentoses and pentosans, ii, 426.
—— heat of formation of, ii, 436.
Furfurimido-ethers, action of hydrazine on, i, 270.
Furfuryl derivatives, nitro-, i, 651.
allo-Furfurylacrylic acid, i, 212.
Furfurylcarbinylic nitrite, i, 22.
Furfurylcyanacrylic acid, nitro-, i, 652.
Furfurylhydrazidine, i, 270.
Furfurylidenedinitrophenylhydrazine, i, 28.
Furfurylidenemalonamide, i, 651.
Furfurylidenemalononitrile, i, 651.
—— nitro-, i, 652.
Furfurylidenepicrylhydrazine, i, 28.
Furfuryltetrazotic acid, i, 270.
Furnace, a gas, ii, 491.
—— combustion, modified, ii, 216.
—— muffle, ii, 260.
Furoylfurfurylhydrazidine, i, 271.
Fusion, latent heat of, PROC., **1895**, 125.
Fusion, latent heat of, and chemical constitution, relationship between, TRANS., 315.

G.

Galactonamide, i, 504.
Galactonic acid, i, 504.
—— anilide, i, 504.
Galactosehydrazonediphenyl, i, 197.
Galena, analysis of, ii, 418.
Gallacetophenone, i, 44.
Gallacetophenoneoxime, TRANS., 997.
Galleïnanilide, i, 54.
—— dimethylic ether, i, 55.
Gallic acid, acetyl- and acetylbromo-derivatives of, i, 283.
—— —— derivatives of, i, 180.
Gallocerin, ii, 409.
Galls of mid Europe, ii, 409.
Galvanic cell, calomel, ii, 377.
—— —— E.M.F. of an iodine, PROC., **1895**, 30.
—— cells, Clark, Gouy, and Daniell, E.M.F. of, ii, 475.
Gamoose, milk of the, PROC., **1895**, 77.
Garnet hornfels from Co. Dublin, ii, 514.
Gas analysis, simple apparatus for, ii, 242.
—— apparatus for passing, into a liquid, ii, 215.
—— coal-, ammonia and nitrogen oxides formed during the combustion of, in air, ii, 62.
—— —— estimation of sulphurous and sulphuric anhydrides in the products of combustion of, ii, 368.
—— electrolytic, condensation of, by porous substances, especially the platinum metals, ii, 150.
—— showing the spectrum of helium, TRANS., 1108; ii, 498.
Gas-batteries, ii, 251.
Gas-gravimeter, ii, 287.
Gas-pump, simple form of, for blood gases, ii, 51.
Gas-volumeter, ii, 287.
Gaseous compounds, double decomposition of, ii, 225.
Gases, electrolysis of, ii, 475.
—— enclosed in rock salt, occurrence of argon in, PROC., **1895**, 143.
—— from wood charcoal at a high temperature, ii, 109.
—— hydrates of, ii, 44.
—— obtained from various minerals, spectra of, ii, 430.
—— of human milk, ii, 405.
—— of blood, exchange of, in brain and muscle, ii, 231, 405.

Gases of the blood, influence of the intravenous injection of *d*-glucose on the, ii, 76.
—— pressure, volume and temperature relations of rarefied, ii, 38.
—— rate of escape of, from solutions of varying concentration, Trans., 869, 983.
—— significance of the ratio of the two specific heats of, ii, 481.
—— specific heat of, ii, 199.
—— specific heats of, at constant volume, ii, 69.
Gastric contents, analysis of, ii, 77.
—— ferments, action of thiocyanic acid on, ii, 403.
—— juice, action of acids and alkalis on, ii, 77.
—— —— analysis of, ii, 543.
—— —— estimation of the chlorine in, ii, 182.
—— —— thiocyanic acid in, ii, 361.
Gaultherin, a new glucoside from *Betula lenta*, i, 109.
Gedanite, i, 385.
Geikielite, from Rakwana, Ceylon, ii, 509.
Geissospermine, i, 194.
Gelaphal, constituents of, i, 189.
Gelatin, estimation of, ii, 543.
—— estimation of, in presence of peptone, ii, 375.
—— sparing influence of, on proteïds in nutrition, ii, 78.
—— substance resembling, derived from ethylic amidoacetate, i, 446.
Geolites, ii, 22.
Geranaldehyde, constitution of, i, 646.
Geraniol, constitution of, i, 646.
—— conversion of, into terpin hydrate, i, 639.
—— detection of, in essential oils, ii, 541.
Geranium oil, examination of rose oil for, ii, 187.
—— —— from Reunion, i, 186.
Germinating process in *Vicia sativa*, ii, 124.
Germination of barley, variations in the sugars during, ii, 363.
—— of lupins, ii, 521.
—— of seeds, ii, 521.
—— of wheat, ii, 521.
Glands, secreting, heat production in, ii, 405.
Glass, remarkable change of structure in, when heated, ii, 447.
Glaucine, i, 690.
Glessite, i, 385.
Glucase, ii, 53.
—— in blood-serum and saliva, ii, 52.
Glucase, yeast-, i, 429.
Glucosamine, i, 323, 493.
d-Glucosamine, i, 640.
d-Glucose, action of ammonia on, i, 320.
—— ammonia derivatives of, i, 640.
—— and lactose, discrimination between, in adulterated peptones, ii, 424.
—— commercial, estimation of cane sugar in presence of, ii, 296.
—— decomposition of, by alkalis, i, 163.
—— detection of, in milk, ii, 425.
—— detection of, in urine, ii, 334.
—— estimation, gravimetric, of, ii, 92.
—— estimation of, by means of alkaline copper solution, ii, 143.
—— estimation of, with ammoniacal copper solution, ii, 92.
—— in blood, ii, 405.
—— influence of intravenous injection of, on the gases of the blood, ii, 76.
—— molecular modifications of, i, 490.
—— multirotation of, i, 586.
—— products of the action of Fehling's solution on, i, 123.
α-Glucose, i, 490.
β-Glucose, i, 490.
γ-Glucose, i, 491.
d-Glucosebenzoylhydrazone, i, 216.
Glucosediacetone, i, 441.
Glucosedimethylacetal, i, 438.
Glucosehydrazonediphenyl, i, 97.
Glucosepentacetins, i, 322.
d-Glucosephenylsulphonehydrazone, i, 216.
Glucoses, constitution of, i, 438, 490.
Glucoside allied to amygdalin, i, 553.
Glucosides, action of invertase and of yeast extract and of emulsin on, i, 6, 7.
—— constitution of, i, 438, 490.
—— examination of corpses for, ii, 465.
—— from the root of *Polygonum cuspidatum*, Trans., 1085.
Glutamine in the green parts of plants, ii, 83.
Glutaric acid, condensation of aldehydes with, i, 127.
—— —— condensation of benzaldehyde with, i, 141.
—— —— condensation of *iso*-valeraldehyde with, i, 127.
—— acids, alkylated, separation and identification of, i, 504.
Glutarimide, i, 591.
Glyceric-α-naphthalide, i, 106.
Glycerol, estimation, gasometric, of, ii, 537.
—— nutrition of green plants by, ii, 126.
Glycerols from secondary allylic alcohols, i, 489.

Glycerophosphoric acid, absorption and elimination of, ii, 237.
Glycide ethyl ether, i, 5.
Glycocine, action of nitrosyl chloride on, Trans., 491.
—— derivatives, synthesis of, i, 144.
—— estimation of, ii, 190.
Glycogen, behaviour of yeast towards, ii, 322.
—— formation of, from inulin in the animal organism, ii, 404.
—— formation of, from sugars, ii, 360.
—— heat of combustion of, ii, 102.
—— in the blood, ii, 233.
—— influence of certain proteïds on solutions of, i, 124.
Glycol, $C_{10}H_{20}O_2$, from dihydrocarveole hydrobromide, i, 550.
Glycoline, amido-, i, 332.
Glycollic acid, substituted ethereal salts of, i, 331.
—— aldehyde, new formation of, Trans., 774.
—— —— phenyl derivatives of, i, 360.
Glycolylhydrazine (amidoglycocine, hydrazineacetic acid), i, 332.
—— anhydride, i, 332.
Glycolysis in blood and tissues, ii, 361.
Glycolytic ferment, ii, 277.
Glycosuria, alimentary, ii, 406.
Glycuronic acid, estimation of, ii, 335.
Glyoxaline, compound of, with platinic chloride, i, 72.
—— compounds, aromatic, i, 304.
Glyoxalinedi-*p*-tolenylhydrazidine, i, 137.
Glyoximes, configuration of, i, 36.
Glyoxylic acid, condensation of, with benzene and toluene, i, 526.
—— —— condensation of, with α-naphthylamine, resorcinol, catechol, *o*-toluidine and *m*-phenylenediamine, i, 171.
—— —— condensation of, with phenols, i, 367.
—— —— derivatives of, i, 525.
—— —— in green fruits, ii, 409.
—— —— phenylhydrazone, i, 461.
—— —— various reactions of, i, 170.
Gold, action of potassium cyanide solutions on, Trans., 199.
—— arsenite, ii, 218.
—— bromide, molecular refraction of dissolved, Trans., 837, 845.
—— chloride, dissociation of, Trans., 881.
—— —— molecular refraction of dissolved, Trans., 836, 844.
—— —— physical properties of, Trans., 905.
—— —— volatilisation of, Trans., 895.
—— colloïdal, ii, 318.
Gold, condensation of electrolytic gas by, ii, 151.
—— crystalline standard, liquation in, Trans., 552.
—— estimation of, in iron and steel ii, 536.
—— extraction of, from auriferous ores by means of bromine, ii, 19.
—— freezing point of, Trans., 189, 1024.
—— rubidium chloride, ii, 319.
—— sodium chloride, mol. refraction of dissolved, Trans., 836. 844.
—— —— sulphide, ii, 274.
—— sulphide, ii, 274.
—— thermal conductivity of, ii, 69.
Gold-antimony alloy, ii, 392.
Gold-bismuth alloy, ii, 392.
Gold-silver-tin-zinc alloys, assay of, ii, 295.
Gooseberries, analyses of, ii, 366.
Gouy cell, E.M.F., of, ii, 475.
Grahamite from Texas, ii, 20.
Grain, feeding with, ii, 453.
Granites, the Leinster, ii, 515.
Graphite, ii, 219.
—— intumescent, ii, 221.
—— laminated from Ceylon, estimation of apatite in, ii, 30.
—— oxidation of, ii, 218.
Graphites from iron, ii, 220.
—— Italian, ii, 400.
Graphitite from Monte Pisano, ii, 504.
Graphitites, Italian, ii, 400.
Grasses, Norwegian hay, analyses of, ii, 324.
Group, $C_nH_2O_2$, constitution of compounds containing, i, 47.
Guaiacol benzoate, action of bromine on, i, 280.
—— preparation of, i, 513.
—— purification of, i, 413.
Guaiacolglycollic acid and amide, i, 45.
Guano, estimation of nitrogen in, ii, 138.
Gum of *Acacia decurrens*, carbohydrates of, ii, 285.
Guye's formula, ii, 473.
Gyalolechia aurella, calycin from, i, 298.
Gypsum crystals, fresh discoveries of, ii, 76.
Gypsum from Bohemia, ii, 277.

H.

Hæmatite, molybdenum and thallium in, ii, 505.
Hæmatoporphyrin in normal urine, ii, 55.
Hæmoglobin, action of acids on, i, 256.
—— copper compound of, ii, 321.
—— estimation of, ii, 321.

Hæmoglobinuria, ii, 82.
Halogens, estimation of by Carius's and the Carius-Volhard methods, ii, 368, 411.
—— estimation of, in their admixed silver salts, ii, 459.
Hardness of water, estimation of, ii, 32.
Heart, frog's, ideal circulating fluid for the isolated, ii, 452.
—— of *Daphnia*, action of drugs on the, ii, 57.
Heat, atomic, rôle of in the periodic series of the elements, ii, 198.
—— capacity of acetic acid and its chloro-derivatives, Trans., 665, 675, 676.
—— equivalents of the amides and anilides of monobasic acids, ii, 482.
—— latent, of fusion, Proc., 1895, 125.
—— —— —— and chemical constitution, relationship between, Trans., 315.
—— of combination of mercury with the halogens and oxygen, ii, 380.
—— —— of water of crystallisation of organic compounds, ii, 202.
—— of combustion of glycogen, ii, 101.
—— —— of the hydroxybenzoic acids, ii, 102.
—— —— of the hydroxytoluic acids and their isomerides, ii, 102.
—— of dissolution, calculation of the, ii, 484.
—— —— of acetic acid and its bromo- and chloro-derivatives, Trans., 667, 676.
—— —— of barium nitride, ii, 255.
—— —— of calcium chloride solutions, ii, 208.
—— —— of campholenic acids, ii, 484.
—— —— of mercuric nitrates, ii, 154.
—— —— of mercury sulphates in dilute sulphuric acid, ii, 103.
—— —— of nitrobenzoic acids, ii, 202.
—— —— of sodamide, ii, 499.
—— —— of sodium acetate, ii, 255.
—— of formation and number of atoms of any given element in a compound, relations between, ii, 340.
—— —— of barium and strontium iodides, ii, 342.
—— —— of cæsium bromide and iodide, ii, 264.
—— —— of calcium carbide, ii, 341.
—— —— of calcium oxybromide and oxyiodide, ii, 304.
—— —— of campholenic actones, ii, 484.
—— —— of camphoric acid, ii, 436.
—— —— of chloracetic chloride, ii, 254.
—— —— of furfuraldehyde, ii, 436.
Heat of formation of iron oxides, carbonate and silicate, ii, 305.
—— —— of mercuric nitrates, ii, 154.
—— —— of mercuric salts, ii, 305.
—— —— of mercuric sulphate, ii, 103.
—— —— of mercurous oxide and salts, ii, 381.
—— —— of nitrobenzoic acids, ii, 202.
—— —— of phthalic chloride and phthalide, ii, 483.
—— —— of potassium hydrogen fluoride, ii, 389.
—— —— of pyromucic acid, ii, 436.
—— —— of salicylaldehyde, ii, 436.
—— —— of saligenol, ii, 436.
—— —— of sodium acetylide, ii, 482.
—— —— of the amides and anilides of monobasic acids, ii, 482.
—— —— of the compounds of barium and calcium oxides with alcohol, ii, 341.
—— —— of the hydroxybenzoic acids, ii, 102.
—— —— of the hydroxytoluic acids and their isomerides, ii, 102.
—— —— of trichloracetic chloride, ii, 254.
—— of fusion of acetic acid and its chloro-derivatives, Trans., 665, 675, 676.
—— of neutralisation of campholenic acids, ii, 484.
—— of vaporisation of saturated fatty alcohols, ii, 101.
—— production in animals, regulation of, ii, 232.
—— —— in glands, ii, 405.
—— —— in the chick after and before hatching, ii, 51.
—— radiation of, at very low temperatures, ii, 123.
—— regulation in hybernating animals, ii, 452.
—— specific, of aniline, influence of temperature on the, ii, 199.
—— —— of carbonic anhydride at constant volume, ii, 69.
—— —— of gases, ii, 199.
—— —— —— at constant volume, ii, 69.
—— —— of hydrogen peroxide, ii, 377.
—— —— of metallic tungsten, ii, 199.
—— —— of red and black forms of mercuric sulphide, ii, 110.
—— —— of superfused salts, ii, 482.
—— —— of water at constant volume, ii, 6.
—— —— —— changes in the, between 0° and 32°, ii, 5.
—— value of nutritive substances, ii, 51.
—— —— of proteïds in the animal organism, ii, 359.
Heat. See also Thermochemistry.

Heats, latent of vaporisation and fusion of substances belonging to the same family, relationship between, ii, 339.
—— of solution and dilution in dissolved dissociated substances, ii, 107.
—— of solution and dissociation of sparingly soluble silver salts of the fatty acids, ii, 435.
—— specific, of gases, significance of the ratio of the two, ii, 481.
—— —— of helium, ratio of the, Trans., 696.
Helenin (alantolactone), i, 554.
Helium, a gaseous constituent of certain minerals, Trans., 685; ii, 498.
—— and argon type, gases of the, ii, 347.
—— density of, Trans., 695, ii, 498.
—— discovery of in clèveite, Trans., 1107; ii, 347.
—— gas showing the spectrum of, ii, 498.
—— properties of, Trans., 690.
—— ratio of the specific heats of, Trans., 696.
—— solubility of in water, Trans., 698.
—— sources of, Trans., 685.
—— spectrum of, Trans., 687, 698, 1108.
—— wave length of sound in, Trans., 695.
Hemimellitic acid, etherification of, i, 228.
Hemipinic acid and its ethereal salts, i, 420.
—— —— formation of veratric acid from, i, 367.
—— —— from corydaline, Trans., 18.
—— —— synthesis of alizarin from, i, 545.
Hemp, alkaloïds from, i, 631.
Hepatic cells at different ages, percentage of sulphur and phosphorus in, ii, 54.
αβ-*iso*-Heptenic acid, i, 206.
—— —— oxidation products of, i, 207.
βγ-*iso*-Heptenic acid, intramolecular change in, i, 206.
—— —— oxidation products of, i, 207.
iso-Heptenolactone, i, 207.
Heptenylamidine salts, i, 265.
Heptenyldiphenyldiureide, i, 265.
Heptenylimidoamylic ether, i, 265.
Heptenylimidobutylic ether, i, 265.
Heptenylimidoethylic ether, i, 265.
Heptenylimidomethylic ether, i, 265.
Heptenylimidopropylic ether, i, 265.
Heptitol, a new, i, 639.
Heptoic acid, affinity constant of, ii, 253.
iso-Heptoic acid, *β*-bromo-, i, 206.
—— —— *αβ*-dibromo-, i, 206.
p-Heptoyltoluene, and its derivatives, Trans., 502.
p-Heptolyltolueneoxime, Trans., 505.
p-Heptolyltoluidide, Trans., 506.
Heptyleneamine from pulegone, i, 154.
Heptylic acetylhydroxybutyrate, rotatory power of, ii, 471.
—— hydroxybutyrate, physical properties of, i, 410.
Herbage of meadows, action of calcium and potassium salts on, ii, 458.
Hesperidin, occurrence of, in *Folia bucco* and the leaves of *Diosma alba*, ii, 408.
Heterogeneous systems, graphical representation of the equilibrium of, ii, 72.
Heulandite from Gunnison Co., Colorado, ii, 510.
Hexacetyltriamidophenol, i, 458.
Hexahydrobenzene, i, 411.
Hexahydrobenzoic acid, *p*-amido-, i, 91.
Hexahydro-*p*-phenylbenzoic acids, stereoisomeric, i, 97.
iso-Hexahydro-*p*-phenylbenzoic acid, i, 98.
Hexahydro-*o*-toluic acid, conversion of the *cis*- into the *trans*- form of, Trans., 127.
cis-Hexahydro-*o*-toluic acid, Trans., 125.
—— anilide, Trans., 126.
trans-Hexahydro-*o*-toluic acid, Trans., 123.
—— anilide, Trans., 124.
cis- and *trans*-Hexahydro-*o*-toluic acids, Trans., 119.
Hexamethylene, i, 411.
—— derivatives, i, 338.
Hexamethylenetetramine, i, 326.
—— action of phenylhydrazine on, i, 444.
—— amyliodide, i, 327.
—— bismuthiodides, i, 590.
—— combination of, with silver salts, i, 261.
—— compounds of, with mercuric chloride, i, 444.
—— constitution of, i, 262.
—— derivatives of, i, 641.
—— hexahydrate, i, 641.
—— hydrobromide, i, 262.
—— properties of, i, 590, 641.
—— reduction of, to trimethylamine, i, 493.
—— salts, i, 590, 641.
Hexamethylparaleucaniline, action of bromine on, i, 56.
Hexamethyltriamidophenylacridine, i, 213, 222.
Hexamethyltriamidotriphenylmethane, i, 476.

Hexamethyltriamidotriphenylmethane, action of methylic iodide on, i, 377.
—— bases from, i, 476.
—— derivatives, i, 377.
Hexanaphthene, isomerides of, i, 454.
—— occurrence of, in Caucasian naphtha, i, 271.
Hexane, normal, vapour-pressures, specific volumes and critical constants of, Trans., 1071.
—— *ϕ*-diamido-, i, 261.
—— *χ*-diamido-, i, 261.
—— dibromo-, i, 590.
Hexanes, 2 : 5-diamido-, isomeric, i, 261.
Hexatriosazone, Trans., 708, 744.
Hexatriose, Trans., 708, 744.
αβ-Hexenic acid, i, 206.
βγ-Hexenic acid, intramolecular change in, i, 206.
Hexiridious acid, potassium salt of, ii, 504.
Hexose, Trans., 780.
Hexyl *p*-tolyl ketone, Trans., 502.
—— —— ketoxime, Trans., 505.
Hexylallylcarbinol, i, 198.
Hexylallylcarbinylic acetate, i, 198.
Hexylaniline, dinitro-, i, 587.
—— trinitro-, i, 587.
Hexylene from hexylnitramine, i, 590.
—— magnetic rotation of, Trans., 257.
Hexylethylene, magnetic rotation of, Trans., 257.
Hexylic alcohol, secondary, i, 590.
Hexylnitramine, i, 589.
Hippuraldehyde, *o*-amido-, anhydride of, i, 89.
—— *o*-nitro-, i, 88.
—— *p*-nitro-, i, 89.
Hippuric acid, action of nitrosyl chloride on, Trans., 491.
—— —— *o*-nitro-, i, 88.
—— —— *p*-nitro-, i, 89,
Hjelmite, helium from, Trans., 689.
p-Homobenzenylamidoximethiocarbinol, i, 662.
p-Homobenzenylhydrazoximido-*p*-bromobenzylidene hydrobromide, i, 662.
—— dibromide, i, 662.
Homologous compounds, refraction and dispersion in, ii, 65.
Homorottlerin, Trans., 233.
Honey, ratio of *d*-glucose to levulose in, and use of this ratio in detecting adulteration, ii, 188.
Hop tannin, i, 470.
Hops, essential oil of, Trans., 54.
Horny tissues, digestion of, by trichophytic fungi, ii, 457.
Horseflesh, putrid, cadaverine and choline from, i, 196.
Human beings, the minimum amount of nitrogen required by, ii, 232.
—— body, relation of fat and carbohydrates to the decomposition of albumin in, ii, 404.
Humulene, Trans., 62.
—— derivatives of, Trans., 780.
—— nitrolbenzylamine, Trans., 781.
—— nitrolpiperidide, hydrochloride, Trans., 780.
—— nitrosate, Trans., 781.
—— nitrosite, Trans., 782.
Humus, nutrition of plants by, ii, 28.
Hydrates, existence of, in solution, Proc., **1895**, 87.
—— of gases, composition of, ii, 44.
Hydrazides of monobasic and dibasic acids of the fatty series, i, 263.
—— of organic acids, i, 32.
Hydrazidocaffeïne, i. 116.
p-Hydrazidodiphenyl, i, 97.
p-Hydrazidodiphenylthiocarbamide, i, 97.
Hydraziglycolide, i, 332.
Hydrazine derivatives having a closed chain structure, i, 246.
—— formation of, from inorganic compounds, ii, 74.
—— free, ii, 347.
—— fumarate, i, 356.
—— hydrate, ii, 496.
—— —— preparation of, ii, 497.
—— —— preservation of solutions of, ii, 11.
—— maleate, i, 356.
—— phthalylhydrazide, i, 355.
—— preparation of, ii, 497.
Hydrazineacetic acid, i, 332.
Hydrazines, a new series of, Trans., 1090.
—— aromatic, synthesis of, from hydrazine hydrate, i, 29, 275.
—— conversion of, into *p*-diamines, i, 520.
—— quaternary, Trans., 1090.
—— unsymmetrical, action of *o*-nitrobenzylic chloride on, i, 353.
Hydrazodicarbonanil, i, 253.
Hydrazodicarbonimide, i, 253.
Hydrazodicarbonthioethylamide, i, 401.
Hydroalantolactone, i, 555.
Hydroalantolamide, i, 555.
Hydroalantolic acid, i, 556.
Hydroaposafranine, i, 528.
Hydrocarbon from picenic acid, i, 293.
—— C_8H_{14}, from amidolauronic acid, i, 296.
—— C_8H_{14}, from sulphocamphylic acid, i, 155.
—— $C_{14}H_{26}$, from pine tar, i, 16, 186.
—— $C_{14}H_{22}$, from pine tar, i, 185.
—— $C_{11}H_{16}$, from alantolactone, i, 556.

Hydrocarbon, $C_{12}H_{18}$, from alantolactone, i, 556.

— $C_{12}H_{16}$, from alantolactone, i, 556.

— $C_{13}H_{16}$, from alantolactone, i, 556.

— $C_{14}H_{18}$, from *p*-heptotoluene, Trans., 507.

Hydrocarbons, aromatic, modification of Zincke's reaction for the preparation of, Trans., 826.

— — use of aluminium in the synthesis of, i, 412.

— from Russian kerosene, action of acetic acid on, i, 77.

— inactive, new class of compounds of, i, 77, 437.

— nature of the aluminium chloride reaction for the synthesis of, i, 130.

— unsaturated, magnetic rotation of, Trans., 255.

Hydrochlorocinchonine, i, 630.

Hydrocinchonine, i, 579, 630.

Hydrocinnamenylacrylic acid, intramolecular change in, i, 223.

Hydrocyanoauramine, i, 145.

Hydrocyano-*p*-rosaniline, i, 541.

Hydrofluoranic acid, salts of, i, 291.

Hydrogalalic acid, i, 180.

Hydrogen, absorption of, by palladium, ii, 388.

— action of, on amorphous phosphorus, ii, 348.

— ammonia and nitrogen oxides formed during the combustion of in air, ii, 62.

— and oxygen, ratio of the atomic weights of, ii, 9.

— atomic refraction of, ii, 430.

— bromide, molecular refraction of dissolved, Trans., 836, 839, 844, 865.

— chloride, action of, on the oxides of barium, calcium, and magnesium, Proc., **1894**, 240.

— — estimation of, in the contents of the stomach, ii, 526.

— — gaseous, electrolysis of, ii, 475.

— — in the stomach, ii, 77.

— — magnetic rotation of solutions of, ii, 196.

— — molecular refraction of dissolved, Trans., 835, 844, 864.

— — rate of, escape of, from aqueous solutions of varying concention, Trans., 876, 880.

— — solution, volumes of between 100° and 150°, ii, 307.

— critical temperature of, ii, 379.

— cuprichloride, ii, 47.

— cuprosochloride, ii, 47.

— cyanide, estimation of, ii, 538.

Hydrogen fluoride, acidimetry of, Trans., 251.

— — combination of, with water, ii, 108.

— — estimation, volumetric, of, Trans., 252.

— iodide, action of ferric acetate on, ii, 111.

— — molecular refraction of dissolved, Trans., 837, 845.

— — occlusion of, by platinum black, ii, 492.

— passage of, through a palladium septum, ii, 39.

— peroxide, action of nitrous acid on, in dilute solution, ii, 496.

— — as a photographic developer, ii, 66.

— — colour, specific gravity and surface tension of, ii, 346.

— — concentration and distillation of, ii, 73.

— — detection of, ii, 526.

— — detection of, in green plants, ii, 239.

— — in green plants, ii, 26.

— — separation of metals in alkaline solution by, ii, 331, 419, 423.

— — specific heat of, ii, 377.

— phosphide, action of, on potasammonium and sodammonium, ii, 75.

— — direct formation of, from its elements, ii, 13.

— rarefied, pressure, volume and temperature relations of, ii, 38.

— specific ionic velocity of, ii, 477.

— sulphide, absorption coefficient of, in water at the freezing point, ii, 104.

— — estimation, colorimetric, of, ii, 289.

— — rate of escape of, from aqueous solutions of varying concentration, Trans., 876, 880.

— — thioacetic acid as a substitute for, in qualitative analysis, ii, 84.

Hydrogeolites, ii, 22.

Hydrohydrastinine, i, 626.

Hydrohydrastinium hydrochloride, physiological action of, ii, 362.

Hydrolysis and etherification, i, 593.

— effect of, on reaction velocities, ii, 159.

— in fermentation, hypothesis as to, Trans., 1136.

— of aromatic nitriles and amido-acids, Trans., 601.

— of ethereal salts, rate of, ii, 107.

Hydromellitic acids, etherification of, i, 471.

Hydropicene, i, 292.

Hydroquinine, action of hydriodic acid on, i, 403.

Hydroquinoline, König's and Lellmann's, i, 69.
Hydroquinolines, constitution of, i, 392.
Hydrosorbic acid, intramolecular change in, i, 206.
Hydrosulphides of aromatic bases, i, 300.
Hydrotometric analysis, avoidance of certain causes of error in, ii, 32.
Hydroxamic acids, i, 393.
Hydroximic acids, chlorides of, i, 88.
Hydroxyacetone, isonitroso-, i, 201.
Hydroxy-acids, action of acidic oxides on salts of, Trans., 102, 1030.
α-Hydroxyadipic acid, Trans., 159.
Hydroxyallyldimethoxybenzene, i, 657.
Hydroxyallylmethoxyethoxybenzene, i, 657.
2-Hydroxyanthracene, 1-amido-, i, 544.
m-Hydroxybenzaldehyde, derivatives of, i, 663.
Hydroxybenzeneindone, i, 528, 610.
—— unsymmetrical, i, 609.
Hydroxybenzenes, poisonous action of, on yeast and bacteria, ii, 130.
Hydroxybenzoic acids, thermochemistry of, ii, 102.
m-Hydroxybenzoic acid, etherification of, i, 229.
p-Hydroxybenzoic acid, etherification of, i, 228.
o-Hydroxybenzoylamidoacetal, i, 90.
Hydroxybenzoylbenzoic acids and their bromo-derivatives, condensation of, i, 235.
o-Hydroxybenzylbenzamide, i, 308.
m-Hydroxybenzylideneamidoacetal, i, 624.
o-Hydroxybenzylideneamidoacetal, i, 90.
o-Hydroxybenzylidene-*o*-amidobenzylaniline, i, 134.
o-Hydroxybenzylidene-*p*-amidobenzylic alcohol, i, 344.
p-Hydroxybenzylidene-*o*-amidodiphenylmethane, i, 53.
Hydroxybenzylideneamidodiphenyl-*m*-phenylenediamine, i, 600.
o-Hydroxybenzylideneamidophenyl-α-naphthylamine, i, 601.
o-Hydroxybenzylidenebenzoylhydrazine, i, 35.
p-Hydroxybenzylidenebenzoylhydrazine, i, 35.
o-Hydroxybenzylidenediantipyrine, i, 483.
Hydroxybenzylidenedimethylethoxydiamidodiphenylamine, i, 27.
o-Hydroxybenzylidene-2 : 4-dinitrophenylhydrazine, i, 27, 29.
p-Hydroxybenzylidene-2 : 4-dinitrophenylhydrazine, i, 27.
p-Hydroxybenzylideneformylhydrazine, i, 263.
o-Hydroxybenzylideneglycolylhydrazine, i, 332.
p-Hydroxybenzylideneglycolylhydrazine, i, 332.
p-Hydroxybenzylidenemalonylhydrazine, i, 264.
p-Hydroxybenzylideneoxalylhydrazine, i, 264.
o-Hydroxybenzylidenephenyl-μ-amidophenylinduline, i, 609.
o-Hydroxybenzylidenepicrylhydrazine, i, 28.
p-Hydroxybenzylidenepicrylhydrazine, i, 28.
p-Hydroxybenzylidenesuccinylhydrazine, i, 264.
o-Hydroxybenzylidene-*o*-*p*-tolylenediamine, i, 599.
o-Hydroxybenzylidine-*p*-nitrosoaniline, i, 598.
Hydroxybenzylindene, i, 535.
—— acetate, i, 535.
Hydroxy-β-benzylpheno-*m*-diazine, i, 251.
o-Hydroxybenzyl-*o*-phenylenediamine, i, 346.
o-Hydroxybenzyl-*p*-phenylenediamine, i, 346.
o-Hydroxybenzyl-*o*-tolylenediamine, i, 346.
α-Hydroxybutyric acid, active derivatives of, i, 409.
—— —— optical isomerides of, i, 333.
—— acids, active ethereal salts of, ii, 471.
β-Hydroxybutyric acid, excretion of, in diabetes, ii, 281.
iso-Hydroxycamphor, i, 676.
Hydroxycamphoric acid, Proc., **1895**, 33, 88.
Hydroxy-*iso*-camphoronic acid, i, 478.
β-Hydroxycaproic acid, i, 206.
Hydroxycarboxylic acids, reaction for, ii, 297.
β-Hydroxycinchonine, i, 310.
3-Hydroxycinchoninic acid methiodide, methochloride, and methylbetaïne, i, 114, 115.
Hydroxy-compounds, effect of, on the freezing point of benzene, ii, 41.
m-Hydroxycoumarin-β-carboxylic acid, i, 420.
Hydroxydihydrocampholenic acid, i, 427.
Hydroxydihydrocampholenolactone, i, 427, 676.
—— constitution of, i, 428, 675.
Hydroxydihydrocampholytic acid, i, 295.

Hydroxydihydrocitrazinimide, dichloro-, i, 157.
—— —— action of phenylhydrazine on, i, 157.
Hydroxydihydrophenonaphthacridine, i, 108.
Hydroxydimethylamidophenylamidophenylnaphthylsulphone, i, 471.
Hydroxydimethyl-*iso*-coumarilic acid, i, 225.
—— —— di- and tri- chloro-, i, 226.
Hydroxydimethylhexyl-*m*-diazine, i, 266.
2 : 1 : 4-Hydroxydimethyl-3-ketonaphthalene, i, 424.
—— oxime of, i, 424.
Hydroxydimethyl-*m*-nitrophenyl-*m*-diazine, i, 266.
Hydroxydimethyl-*iso*-phthalic acid, i, 52.
4′ : 2 : 2′-Hydroxydimethylquinazoline, synthesis of, i, 571.
Hydroxy-*m*-dinitrodiphenylcyanidine, i, 266.
Hydroxydiphenyl, *p*-nitro-, i, 290.
Hydroxydiphenylacetic lactone, i, 419.
Hydroxydiphenylcarboxylic acids, i, 233.
2 : 6-Hydroxydiphenylcarboxylic acid, i, 234, 373.
3 : 2-Hydroxydiphenylcarboxylic acid, i, 233.
2 : 2′-Hydroxydiphenylcarboxylic lactone, i, 372.
4′ : 2-Hydroxydiphenylcarboxylic acid, i, 373.
Hydroxydiphenylene ketone, i, 147, 233.
Hydroxydiphenylenepyrodiazoline (?), i, 213.
Hydroxydiphenylethylamine, heterocyclic bases from, i, 596.
iso-Hydroxydiphenylethylamine, i, 596.
Hydroxydiphenylethylcarbamide, i, 596.
o-Hydroxydiphenylmethane, i, 53.
Hydroxydiphenylquinoxaline, chloro-, i, 573.
4 : 1 : 2-Hydroxydiphenyltriazine, i, 251.
2 : 4-Hydroxyethoxybenzoic acid, Trans., 995.
5-Hydroxyethoxy-3 : 1-methylphenylpyrazole, i, 397.
α-Hydroxy-β-ethylpheno-*m*-diazine, i, 250.
—— m. p. of, i, 306.
6 : 1-Hydroxyethyl-2-pyridone, i, 558.
4′ : 2-Hydroxyethylquinazoline, i, 571.
Hydroxyfurfurazane derivatives, i, 393.
Hydroxyfurfurazaneacetic acid, i, 394.
Hydroxyfurfurazanecarboxylic acid, i, 394.
o-Hydroxyfluorenone, i, 372.
β-Hydroxy-*iso*-heptoic acid, i, 206.
Hydroxy-*iso*-heptolactone, i, 207.
Hydroxyhexahydrophenylbenzoic acid, i, 98.
m-Hydroxyhexahydro-*p*-toluic acid, i, 674.
Hydroxyhexyl-*m*-diazinecarboxylic acid, i, 266.
Hydroxyhexylphenyl-*m*-diazine, i, 266.
o-Hydroxyhippuraldehyde, i, 90.
—— phenylhydrazone, i, 90.
Hydroxyketostearic acid, constitution of, i, 648.
Hydroxylamine, acid sulphate of, Trans., 226.
—— derivatives, occurrence of polymorphous modifications of, i, 37.
—— detection of, ii, 413.
—— phthalylhydroxamate, i, 417.
—— physiological action of, ii, 413.
—— properties of, ii, 413.
Hydroxylamineacetic acid, i, 125.
α-Hydroxylamine-*iso*-butyric acid, i, 521, 522.
α-Hydroxylaminepropionic acid, i, 125.
Hydroxylamines, aromatic, formation of, i, 417.
Hydroxylapachol, barium derivative of, Trans., 788.
—— calcium and silver derivatives of, Trans., 791.
—— from the seeds of *Lomatia ilicifolia* and *L. longifolia*, Trans., 787.
—— isomeride of, Trans., 793.
Hydroxymethoxybenzoylbenzoic acid, i, 545.
Hydroxymethylamidophenyl-*m*-diazine, i, 266.
o-Hydroxymethylbenzoic acid, thermochemistry of, ii, 102.
Hydroxmethylene compounds, i, 62.
—— —— from ketones of the terpene series, i, 187.
Hydroxymethylenebenzyl *iso*-propyl ketone, i, 396.
Hydroxymethylenecamphor, i, 62.
—— anhydride of, i, 63.
—— hydrogen phosphite, i, 63.
Hydroxymethylenecamphorphenylpyrazole, i, 63.
Hydroxymethylenecarvone, i, 187.
Hydroxymethylenementhone, i, 65.
Hydroxymethylenepropyl phenyl ketone, i, 65.
Hydroxymethylenethujone, i, 187.
Hydroxymethylethylhexyl-*m*-diazine, i, 266.
Hydroxymethylethyl-*m*-nitrophenyl-*m*-diazine, i, 266.

4′ : 2 - 2′-Hydroxymethylethylquinazoline, i, 571.
Hydroxymethylhexyl-*m*-diazine, i, 266.
Hydroxymethyl-*m*-nitrophenyl-*m*-diazine, i, 266.
Hydroxy-β-methylphenyl-*m*-diazine, i, 250.
Hydroxymethylphenyltriazole, i, 573.
4′ : 2 : 2′-Hydroxymethyl-*iso*-propylquinazoline, i, 572.
4′ : 2-Hydroxymethylquinazoline, synthesis of, i, 571.
2 : 2′-Hydroxymethylquinoline, i, 666.
α-Hydroxy-β-methyl-*p*-toluo-*m*-diazine, i, 399.
—— real nature of, i, 572.
2 : 1-Hydroxynaphthalenecarboxylic acid, rate of etherification of, i, 228.
3 : 2-Hydroxynaphthalenecarboxylic acid, etherification of, i, 228.
Hydroxynaphthalide, phenylhydrazone of, i, 240.
α-Hydroxynaphthaphenazine, β-chloro-, i, 615.
2-Hydroxy-1 : 4-naphthaquinone, iodo-, i, 237.
2-Hydroxy-1 : 2-naphthaquinone-4-anilido-*o*-carboxylic acid, i, 107.
2-Hydroxy-1 : 4-naphthaquinoneoxime, iodo-, i, 237.
2′-Hydroxy-1 : 2-naphthaquinone-4-sulphonic acid, i, 106.
3 : 2-Hydroxynaphthyl-1 : 4-naphthaquinone, Trans., 659.
Hydroxy-μ-naphthylnaphthindone, i, 613.
Hydroxy-*m*-nitrophenyl-*m*-diazinecarboxylic acid, i, 266.
Hydroxy-*m*-nitrophenylphenyl-*m*-diazine, i, 266.
β-Hydroxy-*iso*-octoic acid, i, 207.
Hydroxy-*iso*-octolactone, i, 208.
Hydroxypentadecoic acid, i, 119.
Hydroxyphenoxyethane, Proc., **1895**, 40.
m-Hydroxy-*o*-phenylbenzoic acid, i, 234.
2′ : 3′ : 1′-Hydroxyphenylbenzyltetrahydroquinazoline, i, 134.
β-Hydroxyphenylbutyric acid, i, 223.
m-Hydroxyphenylbutyric acid, i, 663.
Hydroxyphenylbutyrolactone, i, 93.
3 : 2′-Hydroxyphenylcinchoninic acid, i, 115.
—— methochloride, methiodide and methylbetaïne of, i, 115.
Hydroxyphenylcoumalin, i, 110.
m-Hydroxyphenylcrotonic acid, i, 663.
Hydroxyphenyl-*m*-diazineacetic acid, i, 266.
Hydroxyphenyldihydrotriazine, i, 460.
3 : 1-Hydroxyphenyl-2-hydroxybenzylpyrazolidone, i, 93.
Hydroxyphenylmaleïnamide, i, 102.
Hydroxyphenylpentenic acid, i, 224.
Hydroxy-β-phenylpheno-*m*-diazine, i, 251.
3′ : 4-Hydroxyphenylquinaldine, i, 430, 431.
4 : 2′-Hydroxyphenylquinaldine, i, 113.
4′ : 2-Hydroxyphenylquinaldinic acid, i, 114.
4′ : 3-Hydroxyphenylquinaldinic acid, i, 114
Hydroxyphenylquinoline (?), i, 251.
1 : 2′-Hydroxyphenylquinoline, i, 71.
3 : 2′-Hydroxyphenylquinoline, i, 72.
4′ : 2-Hydroxyphenylquinoline, i, 113.
4′ : 3-Hydroxyphenylquinoline, i, 113.
1 : 2′-Hydroxyphenylquinoline-4′-carboxylic acid, i, 71.
3 : 2′-Hydroxyphenylquinoline-4′-carboxylic acid, i, 72.
3 : 4-Hydroxyphenyltetrazole, i, 194.
p-Hydroxyphenylthiourea, Trans., 559.
β-Hydroxyphenylvaleric acid, i, 224.
p-Hydroxypropiophenone, behaviour of, in the animal organism, ii, 25.
α-Hydroxy-β-propylidenebutyric acid, i, 16.
—— —— dibromide, i, 16.
Hydroxy-β-propylpheno-*m*-diazine, i, 250.
α-Hydroxy-β-*iso*-propylpheno-*m*-diazine, i, 250.
—— m. p. of, i, 306.
4′ : 2-Hydroxy-*iso*-propylquinazoline, i, 572.
3-Hydroxypyridine, i, 391.
4-Hydroxypyridine-2 : 6-dicarboxylic acid, Trans., 403.
4′-Hydroxyquinazoline, preparation of, i, 571.
Hydroxy-*iso*-quinoline [1 or 4], i, 683.
—— benzylobromide, i, 683.
—— benzylohydroxide, i, 684.
—— ethiodide, i, 683.
—— ethobromide, i, 683.
—— ethohydroxide, i, 684.
—— methiodide, i, 683.
—— methohydroxide, i, 684.
m-2-Hydroxy-*iso*-quinoline, i, 624.
Hydroxyquinoxaline, trichloro-, i, 511.
Nt_2-2′-Hydroxyrosindone, i, 611.
Nt_2-3′-Hydroxyrosindone, i, 611.
m-Hydroxystilbene, i, 663.
m-Hydroxystilbenecarboxylic acid, i, 663.
Hydroxyterpenylic acid, i, 153.
—— —— and its lactone, constitution of, i, 675.
Hydroxyterpineoloxime, i, 547.
Hydroxytoluic acids, thermochemistry of, ii, 102.
Hydroxy-*p*-tolyl-*m*-diazineacetic acid, i, 266.

β-Hydroxyvaleric acid, i, 204.
Hygric acid, i, 311.
Hygrine, i, 310.
—— low boiling, i, 311.
Hygroscopic substances, drying of, ii, 325.
Hypogæic acid, constitution of, i, 126.
Hyposulphurous acid, ii, 9.
Hypoxanthine, separation of adenine and uric acid from, ii, 94.
Hystazarin dimethyl ether, i, 232.
—— methyl ether from chay root, Trans., 819, 822.
—— synthesis of, i, 232.

I.

Ice, artificial, ii, 73.
Icosenic acid, i, 127.
Icosinic acid, i, 127.
Iditol, i, 650.
Idocrase, composition of, ii, 511.
Idonic acid, i, 650.
Idosaccharic acid, i, 650.
Idose, i, 650.
Ilicene, i, 182.
Ilmenite, sphene and rutile, genetic relations of, ii, 400.
Imidazolones and their decomposition products, i, 218, 400.
Imidodicarboxylic acid, sulphur derivatives of, i, 605.
Imido-ethers, i, 264.
—— —— action of hydrazine on, i, 136.
Inanition in a dog, loss of material in, ii, 78.
Indene, action of nitrous acid on, i, 475.
—— constitution of, i, 535.
—— nitrosites of, i, 475.
India rubber, analysis of, ii, 191.
—— —— wares, analysis of, ii, 96.
Indican, i, 96.
—— sugar from, i, 96, 189.
Indicator, luteol, a new, i, 572.
Indicators, i, 572; ii, 134, 242, 325.
—— comparison of, ii, 325.
—— litmus and methyl-orange as, ii, 134, 242, 325.
Indiglucin, identity of, with glucose, i, 189.
Indigo, i, 96.
—— preparation of, i, 96.
Indigo-carmine, action of, in dyeing silk, ii, 259.
Indigo-gluten, nature of, i, 96.
Indigopurpurin, i, 288.
Indigotin, *m*-dibrom-, i, 288.
—— *m*-dichlor-, i, 288.
—— estimation of, ii, 468.
Indigotin, m. p. of, ii, 379.
—— red isomeride of, i, 288.
—— synthesis of, i, 231.
—— synthesis of, from ethylenedianthranilic acid, i, 536.
Indirubin, i, 288.
Indole as a test for nitrites, ii, 63.
—— compound of, with symmetrical trinitrobenzene, i, 653.
—— derivatives, i, 371,
—— —— synthesis of, i, 144.
—— from *o*-diamidostilbene, i, 534.
Indone from the oxidation of orthamidoditolylamine, i, 25.
Indophenols, i, 416.
—— preparation of *p*-quinones from, i, 416.
Inductive capacities, specific, of water, alcohol, &c., measurement of, ii, 197.
Induline, constitution of, i, 148.
—— group, i, 527, 608.
Indulines, relation of the safranines to, i, 527.
Inorganic compounds, constitution of, ii, 225, 499.
Inosic acid, i, 580.
Intestinal juice, action of, on starch, ii, 403.
Intestine, small, inversion of cane-sugar in, ii, 405.
Intestines, mycological processes in the, ii, 453.
Inulin, formation of, from glycogen in the animal organism, ii, 404.
Invertase, action of, on various glucosides and carbohydrates, i, 6.
Iodides, metallic, action of ferric chloride on, ii, 395.
Iodine, atomic refraction of, ii, 430.
—— cell, E.M.F. of an, Proc., 1895, 30.
—— chlorine and bromine, estimation of, in their admixed silver salts, ii, 459.
—— combination of sulphur with, ii, 163.
—— commercial, estimation of chlorine in, ii, 136.
—— detection and estimation of chlorine in presence of, ii, 242.
—— detection of, in urine, ii, 136.
—— determination of the molecular weight of, in solution, ii, 382.
—— estimation of, in organic compounds, ii, 326.
—— estimation of mercury in the presence of, ii, 87.
—— solubility of, in carbon bisulphide at low temperatures, ii, 489.
—— solutions, sodium thiosulphate for standardising, ii, 63.
—— —— spectrophotometric researches on, ii, 193.

Iodine solutions, titration of, with barium thiosulphate, Trans., 314.
Iodine-green, constitution of, i, 542.
Iodoform, solubility of, in alcohol and ether, i, 633.
Iodonium bases from *p*-chloriodobenzene, i, 221.
—— —— from *p*-iodotoluene, i, 221.
—— compounds, preparation of, i, 635.
Ionic dissociation, hypothesis of, Trans., 1124.
Ionisation and osmotic pressure, cause of, ii, 308.
Ionone-*p*-bromophenylhydrazone, i, 530.
iso-Ionone-*p*-bromophenylhydrazone, i, 539.
Iononesemicarbazone, i, 530.
Ions, atoms and molecules, colour of, ii, 441.
—— optical rotation of, ii, 65.
—— velocities of the, ii, 477.
Iridious acid, polymerides of, ii, 504.
Iridium, condensation of electrolytic, gas by, ii, 151.
—— potassium nitrites, action of heat on, ii, 503.
Iridol, colour reaction of, i, 87.
Iron, action of nitrous oxide on, at a high temperature, ii, 312.
—— action of nitrous oxide on, in presence of water, ii, 495.
—— amount of in urine, ii, 407.
—— boride, ii, 270.
—— cast, estimation, volumetric, of phosphorus in, ii, 414.
—— chromates, ii, 227.
—— compounds, assimilated, distribution of in animal and vegetable cells, ii, 518.
—— detection and estimation of in oils, ii, 463.
—— detection of in commercial copper sulphate, ii, 534.
—— estimation of carbon in, ii, 330, 531.
—— estimation of gold and silver in, ii, 536.
—— estimation of, i ash of vegetable or animal matter, ii, 89.
—— estimation of, in ores, slags, &c., ii, 420.
—— estimation of, in phosphates, ii, 140, 246, 293.
—— estimation of in urine, ii, 407.
—— estimation of phosphorus in, ii, 328, 414, 530.
—— estimation of sulphur in, ii, 244, 411, 527, 528.
—— estimation, volumetric, of manganese in, Trans., 275.
—— fused cast, displacement of carbon from by boron and silicon, ii, 220.
—— graphites from, ii, 220.
Iron, in the liver, ii, 173.
—— magnetic oxide of, heat of formation of, ii, 305.
—— meteoric, detection and estimation of selenium in, ii, 369.
—— moist, reduction of nitric oxide by, ii, 445.
—— native, ii, 20.
—— nitroso-compounds of, ii, 317, 451.
—— percentage of, in the liver in *ankylostomiasis*, ii, 56.
—— phosphate, removal of the phosphoric acid from as alkali phosphate, ii, 112.
—— pig, estimation of sulphur in, ii, 244.
—— pyrites, chemical constitution of, ii, 20.
—— separation, electrolytic, of zinc from, ii, 89.
—— separation of arsenic from, ii, 462.
—— separation of manganese from, ii, 419.
—— separation of nickel from, ii, 293.
—— separation, qualitative, of chromium from, ii, 88.
—— thiohypophosphate, ii, 13.
—— titration of, with sodium sulphide, ii, 64.
—— See also Ferrous and Ferric.
Iron-nickel pyrites from Norway, ii, 171.
Irone-*p*-bromophenylhydrazone, i, 530.
Ironesemicarbazone, i, 530.
Irons, temperatures of transformation of, ii, 110.
Isatincarboxylic acid, i, 543.
Isatin-β-oxime, *m*-chloro-, i, 288.
Isatinphenylhydrazone, brom-, i, 288.
—— nitro-, i, 288.
Isatin-*o*-tolylhydrazone, i, 288.
—— *m*-chloro-, i, 288.
—— nitro-, i, 288.
Isatin-*p*-tolylhydrazone, i, 288.
—— *m*-chloro-, i, 288.
—— nitro-, i, 288.
Isomeric change, arrest of at an intermediate stage, Proc., **1895**, 49.
Isomorphism, ii, 160, 309.
Isomorphous mixtures, ii, 257.
—— —— freezing points of, ii, 207.
—— salts, melting points of mixtures of, ii, 36.
—— —— solubility of mixed crystals of pairs of, ii, 7.
Isoprene, magnetic rotation of, Trans., 258.
Isosmotic concentrations, determination of, ii, 208, 381, 488.

J.

Jack-fruit tree, constituents of the wood of, Trans., 937.

"Jaune siderin," composition of, ii, 227.
Jute, action of aqueous soda and carbon bisulphide on, Trans., 444.

K.

Kainite, estimation of potassium in, ii, 417.
Kairoline, i, 480.
Kamala, Trans., 230.
—— yellow crystalline colouring matter from, Trans., 233.
Kamarezite, from Kamareza, Laurion, Greece, ii, 506.
Kammererite from Tampadel, Silesia, ii, 172.
Kaolin, constitution of, ii, 358.
Katapleite from Greenland, ii, 23.
Keratin, a new decomposition product of, i, 160.
—— substances, amount of sulphur in, i, 255.
Ketoazocamphoquinone, i, 61.
—— bromination of, i, 382.
iso-Ketocamphoric acid, i, 478.
Keto-compounds, effect of on the freezing point of benzene, ii, 41.
Ketodihydroquinoline, probable identity of with ethylkynurine, i, 71.
Ketohydrindenecarboxylic acid, chlorodibromo-, i, 231.
—— —— —— bibasic acid from, i, 231.
Ketohydroxystearic acid, i, 82.
—— —— phenylhydrazide of, i, 82.
αα-Ketoindenecarboxylic acid, β-chloro-, i, 231.
Ketone, $C_7H_{12}Cl_2O$, from ethylpropylacetylene, and hypochlorous acid, i, 497.
—— $C_{10}H_{16}O$, from pinole tribromide, i, 60.
—— $C_9H_{12}O_5$, from ethylic aconitate, i, 212.
—— $C_{10}H_{10}Br_2O_2$, from the oxidation of bromanethoïl dibromide, i, 341.
Ketones, action of hydrogen sulphide on, i, 362.
—— aliphatic, oxidation of, by nitric acid, i, 201.
—— amido-, aliphatic, i, 685.
—— and diethylic succinate, synthesis of unsaturated dicarboxylic acids from, i, 142.
—— aromatic hydroxy-, behaviour of, in the animal organism, ii, 25.
—— combination of polyhydric alcohols with, i, 441.
—— compounds of sugars with, i, 437.
—— condensatison of aldehydes with, i, 643.
Ketones, condensation of ethylic salts of dibasic acids with, i, 410.
—— conversion of, into α-diketones, i, 499.
—— β-halogenated, i, 361.
—— *iso*-nitroso-, constitution of, i, 498, 623, 647.
—— of the terpene series, hydroxymethylene compounds from, i, 187.
—— thio-derivatives of, i, 362.
α-Ketonic acids, condensation of the salts of, with *o*-toluidine, i, 666.
β-Ketonic acids, electrical conductivity of ethereal salts of, i, 649.
Ketonic compounds, elimination of carbonic oxide from, i, 329.
Keto-oleic acid, i, 647.
Ketopalmitic acid, i, 127.
Ketopentene, hexachloro-, acid $C_5H_6O_2$ from, i, 510.
Ketophenylparacophenone, i, 48.
Ketostearic acid, chloro-, i, 647.
—— —— —— constitution of, i, 648.
—— —— constitution of, i, 648.
Ketotetrahydroquinazoline, oxidation of, i, 306.
Ketoximeketobehenic acid, i, 208.
Ketoximes, action of nitric peroxide on, i, 445.
Kjeldahl process, apparatus for measuring small drops of mercury for the, ii, 369.
Kola nut, chemical composition of, ii, 241.
Kühnite, ii, 508.
Kynurine, synthesis of, i, 70.

L.

Lac tree, sap of the, i, 385.
Laccase, i, 385, 386.
Laccol, i, 386.
Lactates, metallic, rotatory power of, ii, 174.
Lactic acid, action of arsenious and antimonious anhydrides on salts of, Trans., 1036.
—— —— estimation of, ii, 174.
—— —— in the urine of rabbits poisoned with carbonic oxide, ii, 175.
—— —— optically active, ethereal salts of, Trans., 914.
—— —— transformation of propionic acid into, i, 197.
—— acids, active, freezing points of solutions of metallic salts of, Trans., 632.
—— —— —— preparation of, Trans., 616.
—— —— —— rotation of their metallic salts in solution, Trans., 616.

Lactide from α-bromopropionic anhydride, i, 17.
Lactone from dichloroxindenecarboxylic acid, i, 231.
Lactose, action of the mucous membrane of the stomach and intestines on, ii, 403.
—— and glucose, discrimination between, in adulterated peptones, ii, 424.
Land, cultivated, drainage from, ii, 458.
Lanolinic acid, i, 408.
Lanolinic alcohol, i, 408.
—— benzoate, i, 408.
Lanthanum oxides, ii, 449.
iso-Lapachone, isomeride of, Trans., 793.
Lard, analysis of, ii, 146.
—— —— the phosphomolybdic acid test in, ii, 467.
Laudanidine, i, 117.
Lauramide, heat of formation of, ii, 483.
Lauric anilide, heat of formation of, ii, 483.
Laurocerasin, i, 554.
Lauronic acid, amido-, hydrocarbon and acids from, i, 296.
—— —— —— inner anhydride of, i, 188.
—— —— amido-derivatives of, i, 187.
iso-Lauronic acid, i, 154.
—— —— phenylhydrazine compound and semicarbazide of, i, 155.
Lauronolamide, i, 154.
Lauronolic acid, preparation of, i, 154.
—— lactone, bromo-, i, 154.
iso-Lauronolic acid, i, 295.
βγ-*iso*-Lauronolic acid (unsaturated), i, 296.
Lauroylbenzene, Trans., 508.
Lavender, oil of, rotatory power of, i, 294.
Lead, action of nitric acid on, ii, 164.
—— action of nitrous oxide on, ii, 312.
—— ammonium iodide, ii, 268.
—— arsenites, ii, 218.
—— bromide, action of light on, ii, 267
—— chlorides, compounds of, with organic bases, i, 391.
—— detection and estimation of, in oils, ii, 463.
—— dioxide, preparation of, ii, 315.
—— estimation, electrolytic, of, ii, 418.
—— hydroxide periodide, ii, 449.
—— iodide, combination of, with metallic iodides and organic iodides, ii, 268.
—— iodine compounds of, containing excess of iodine, ii, 449.
—— liquation caused in standard gold by the presence of, Trans., 552.
—— lithium iodide, ii, 268, 350.
—— nitrate, molecular refraction of dissolved, Trans., 838, 846, 865.
Lead orthonitrate, ii, 316.
—— oxide, action of the spark discharge on, ii, 267.
—— oxidising action of ammonia solution on, Proc., **1895**, 9.
—— potassium acetate periodide, ii, 449.
—— precipitation of metallic, ii, 315.
—— rottlerin, Trans., 235.
—— selenide, crystallisation of, ii, 391.
—— separation of antimony from, ii, 89, 422.
—— separation of arsenic from, ii, 89, 462.
—— separation of bismuth from, ii, 536.
—— separation of cadmium from, ii, 332.
—— separation of mercury from, ii, 332, 533.
—— separation of tin from, ii, 89, 422, 462.
—— sodium iodide, ii, 268.
—— sulphide and oxide, effect of heat on a mixture of, ii, 450.
—— —— and sulphate, effect of heat on a mixture of, ii, 450.
—— —— behaviour of, on heating, ii, 450.
—— —— crystallisation of, ii, 391.
—— thiohypophosphate, ii, 13.
—— titration of, with sodium sulphide, ii, 64.
—— triphosphate, ii, 446.
Leaf respiration, ii, 175.
Leaves, dried, evolution of carbonic anhydride from, ii, 124.
—— green and etiolated, respiration of, ii, 176.
Lecithin, estimation of, in plants, ii, 96.
Lecture experiment: gain of weight in combustion, ii, 260.
—— —— on ethylic ether, ii, 73.
Leech, salivary glands of the, ii, 53.
Lemon oil, occurrence of citronellal in, i, 382.
—— —— sp. gr. and rotatory power of, ii, 541.
Lepra candelaris and *L. chlorina*, calycin in, i, 298.
Leucaniline, action of bromine on, i, 56.
—— hydrochloride, electrolytic conductivity of, i, 540.
Leucine from pancreatic digestion, i, 83; ii, 25.
Leucocytes, disappearance of, from blood after injection of peptone, ii, 79.
Leucophthaleïns, i, 55.
Leuco-*p*-rosaniline, sulphone of, i, 285.
β-Levulin, i, 165.
Levulinic acid, bromo-, action of thiocarbamide on, i, 495.
—— —— dibromo-, action of thiocarbamide on, i, 495.

Levulinic hydrazide i, 247.
Levulose from the dried peel of *Citrum aurantium Chinensis*, ii, 129.
—— influence of, in diabetes, ii, 281, 520.
Lewisite from Brazil, ii, 508.
Licareol and linalol, i, 77.
Lichens, compounds from, i, 297, 298.
Light, action of, on antimony pentasulphide, Trans., 528.
—— action of, on lead bromide, ii, 267.
—— action of, on tetanus cultures, ii, 58.
—— bactericidal action of, ii, 57.
—— coloured, method of obtaining, of sufficient purity for the determination of rotatory dispersion, ii, 1.
—— emission of, during crystallisation, ii, 66, 429.
—— magnetic rotation of the plane of polarisation of, in liquids, ii, 474.
—— measurement of the intensity of, by chemical means, ii, 249.
—— monochromatic, burner for, ii, 345.
Lignocellulose, new type of, i, 493.
Lignocelluloses, action of nitric acid on, i, 323.
Limonene, constitution of, i, 675.
—— nitrolanilides, i, 479.
—— nitrosochlorides, i, 380, 478, 546.
—— oxidation of, i, 674.
—— tetrabromide, action of sodium methoxide on, i, 59.
Linalol and licareol, i, 77.
—— constitution of, i, 646.
d-, and *l*-Linalol, conversion of, into terpin hydrate, i, 639.
"Lindesite," ii, 76, 513.
Linseed oil, analysis of, ii, 147.
Liquation in crystalline standard gold, Trans., 552.
Liquid and solid phases, equilibrium between, ii, 158.
—— at constant temperature, influence of the relative volumes of liquid and vapour on the vapour pressure of, ii, 203.
—— mixtures, freezing point of, ii, 204.
—— molecules, complexity and dissociation of, ii, 40.
Liquids, critical temperature as a test for the purity of, ii, 200.
—— determination of the molecular weight of, ii, 99.
—— holding solids in solution, critical temperature of, ii, 201.
—— non-associating, molecular surface energy of, ii, 40.
—— polymerisation in, ii, 8.
—— volume changes attending the mixture of, in relation to cryoscopic behaviour, ii, 6.
Liroconite from Cornwall, ii, 507.
Lithium amidochromate, non-existence of, ii, 273.
—— bromide, hydrates of, ii, 350.
—— chloride, hydrates of, ii, 348, 350.
—— —— molecular refraction of dissolved, Trans., 835, 839, 844, 864.
—— —— physical properties of solutions of, in amylic alcohol, ii, 383.
—— chlorochromate, ii, 272.
—— cupriferrocyanide, i, 487.
—— cuproferrocyanide, i, 487.
—— *l*-lactate, Trans., 625.
—— lead iodide, ii, 268, 350.
—— nitrate, molecular refraction of dissolved, Trans., 837, 845.
—— salts, detection and estimation of sodium in, ii, 532.
—— thallium chloride, ii, 399.
Litmus and methyl-orange as indicators, ii, 134, 242, 325.
Liver and the metabolism of carbohydrates, ii, 360.
—— cells at different ages, percentage of sulphur and phosphorus in, ii, 54.
—— —— changes in, under the action of various drugs, ii, 79.
—— in *ankylostomiasis*, percentage of iron in, ii, 56.
—— of the ox, calcium in the, ii, 53.
Lomatia ilicifolia, colouring matter from, Trans., 784.
—— *longifolia*, Trans., 784.
Lossenite from Laurion, ii, 172.
Lucern, chlorophylls from, i, 389.
Lupins, germination of, ii, 521.
Lupinus albus, alkaloïds of, i, 311.
—— *luteus*, crystalline nitrogenous compounds in the seedlings of, ii, 84.
Luteol, i, 572.
Lutidine hydrochloride, compounds of, with lead dichloride and tetrachloride, i, 390.
Lymph, action of intravenous injection of sodium chloride solution on the composition of, ii, 173, 362.
Lymph-cysts, liquid contained in, ii, 280.
Lysidine, i, 73.

M.

Maclurin, constitution of, i, 538.
—— derivatives of, Trans., 933.
Maclurinazobenzene-*p*-sulphonic acid, sodium salt of, Trans., 934.
Magdala-red, base of, i, 612.

Magenta, acid-, constitution of, i, 539, 540.
—— action of hydrochloric acid on, i, 278.
Magnesia, solubility of, in sugar solutions, i, 79.
Magnesite, formation of, ii, 50.
Magnesium, action of, on manganous salts, ii, 316.
—— action of, on moist nitrous oxide, ii, 495.
—— action of, on the vapours of alcohols, i, 405.
—— arsenites, ii, 218.
—— carbonate, estimation of, in soils, ii, 245.
—— chloride, hydrates of, ii, 226, 269.
—— —— molecular refraction of dissolved, Trans., 836, 844.
—— compounds, elimination of, in cases of rachitis, ii, 455.
—— cupriferrocyanide, i, 407.
—— cuproferrocyanide, i, 407.
—— detection of, ii, 64.
—— diphenyl, i, 143.
—— effect of, on the development of the organised structures of the cell, ii, 457.
—— freezing point of, Trans., 186.
—— *d*-lactate, Trans., 626.
—— nitride, action of phosphorus trichloride on, ii, 46.
—— oxide, action of dry hydrogen chloride on, Proc., **1894**, 240.
—— position of, in the genetic system of the elements, ii, 107.
—— potassium fluorides, ii, 351.
—— —— silicate, ii, 351.
—— salts, action of, on the animal organism, ii, 53.
—— sulphate, molecular refraction of dissolved, Trans., 838, 866.
—— voltaic cell, ii, 35.
Magnetic rotation of the plane of polarisation of light in liquids, ii, 474.
—— —— of solutions of hydrogen chloride, ii, 196.
—— —— of unsaturated hydrocarbons, Trans., 255.
—— —— of water, ii, 474.
—— —— of carbon bisulphide, ii, 474.
Magnetism, influence of, on chemical action, ii, 153.
Maize meal, fat of, i, 501.
—— pentosans in, ii, 177.
Malachite-green, constitution of, i, 234.
—— —— oxime and phenylhydrazone of, i, 234.
Maleïc acid, chloro-, i, 19.
Maleimide, *n*-amido-, i, 356.
Maleïnanil, dichloro-, i, 177.
Maleïndianil, dichloro-, i, 177.
Maleïn-*p*-toluildipiperidide dichloro-, i, 177.
Maleylhydrazide, i, 356.
Malic acid, action of antimonious oxide on the salts of, Trans.,
—— —— rotatory power of ethereal salts of, ii, 251.
Malonamide, action of aniline on, Trans., 1006.
—— action of nitrosyl chloride on, Trans., 490.
—— diamido-, Trans., 1003.
—— imido-, i, 266.
—— nitro-, Trans., 1005.
Malondihydroxamic acid, i, 393.
Malonhydrazide, i, 263.
Malonic acid, amido-, Trans., 1006.
—— —— derivatives of, Trans., 1002.
Malt, comparative saccharifying and liquefying powers of, i, 692.
—— means of varying and regulating the degree of fermentation of, ii, 181.
—— varying composition of, ii, 181.
Maltodextrin, preparation of, Trans., 703.
Maltol, i, 80, 164.
—— constitution of, i, 80.
Maltosazone, Trans., 742.
—— modification of, by the osazone derivatives of maltodextrin, Trans., 734.
"*iso*-Maltosazone," Trans., 706, 719—728, 730, 731, 735, 740, 744.
—— synthetical production of, Trans., 731.
Maltose, action of the diastase of kiln-dried malt on, Trans., 742.
—— action of the mucous membrane of the stomach and intestines on, ii, 403.
—— action of yeast extract and of invertase on, i, 6.
—— action of yeast on, Proc., **1895**, 46; i, 442.
—— and its anhydride, i, 7.
—— birotation of, Trans., 312.
—— estimation, gravimetric, of, with Fehling's solutions, Trans., 999.
—— hydrolysis of, by yeast, Proc., **1895**, 46; i, 442.
—— specific rotatory power of, i, 260.
"*iso*-Maltose," action of the mucous membrane of the stomach and intestines on, ii, 403.
—— fermentation of, Trans., 729.
—— Lintner's, Trans., 706, 707, 709, 714, 739.
Manaca roots, pharmacological investigation of, ii, 57.
Manaceïn, ii, 57.
Manacin, ii, 57.

Mandelic acid, condensation of, with phenols, i, 419.
—— —— thermochemistry of, ii, 102.
Manganese alloys, spectra of, ii, 432.
—— ammonium alum, ii, 394.
—— —— pyrophosphomolybdate, ii, 230.
—— —— sodium pyrophosphotungstate, ii, 230.
—— —— sulphate, ii, 394.
—— arsenites, ii, 218.
—— chloride and cobalt chloride, mixed crystals of, ii, 209.
—— —— hydrates of, ii, 226, 269.
—— compounds, spectra of, ii, 432.
—— cyanides, double, i, 485.
—— dioxide, apparatus for the assay of, by Bunsen's method, ii, 88.
—— estimation, electrolytic, of, ii, 419.
—— estimation, volumetric, of, Trans., 268; ii, 420.
—— natural oxides of, ii, 50.
—— nitrides, ii, 16.
—— oxide, new, ii, 395.
—— separation of copper from, ii, 332, 419.
—— separation of iron and copper from, ii, 419.
—— separation of mercury from, ii, 332.
—— separation of silver from, ii, 423.
—— sodium pyrophosphomolybdate, ii, 230.
—— —— pyrophosphotungstate, ii, 230.
—— spectrum of, ii, 432.
—— sulphide, precipitated, crystallisation of, ii, 267.
—— —— protomorphic state of, ii, 224.
—— titration of, with sodium sulphide, ii, 64.
Manganese-steel, ii, 16.
—— —— magnetic properties of, ii, 16.
Manganic chloride, double salts of, ii, 46.
Manganine, thermoelectric properties of, ii, 152.
Manganous oxide, action of nitrous oxide on, ii, 312.
—— salts, action of magnesium on, ii, 316.
—— sulphate, anhydrous crystallised, ii, 394.
Mangel wurzel, digestion of, ii, 452.
Mannan as a reserve material in the seeds of *Diospyros kaki*, ii, 128.
Mannitol, action of, on Fehling's solution, ii, 408.
—— estimation of, by the optical method, ii, 141.
—— estimation of, in wines, ii, 334.
—— formation of, in wines, i, 198.
Manure, farmyard and green, utilisation of the nitrogen of, ii, 367.
Manures, estimation of nitrates in, ii, 370.
—— estimation of nitrogen and phosphoric acid in, ii, 243.
—— estimation of potassium in, ii, 417.
—— mineral, effect of various, on the saline components of potatoes and oats, ii, 130.
Manuring experiments on various phosphates and nitrogenous substances, ii, 180.
—— natural meadows, ii, 458.
Marcasite and pyrites, chemical character of, ii, 316.
Margarine, detection of in butter, ii, 145.
Marignac memorial lecture, Trans., 468.
—— titles of published papers by, Trans., 485.
Marmora, water of the Sea of, ii, 515.
Marshite from Broken Hill, N.S.W., ii, 504.
Mass action, law of, ii, 384.
Mauveïnes, relations of the safranines to, i, 527.
Mauvindone, i, 610.
Meadows, action of calcium and potassium salts on the herbage of, ii, 458.
—— natural, manuring of, ii, 458.
Meat extract, estimation of the nitrogenous constituents of, ii, 543.
—— extracts, analysis of, ii, 543.
α-Medicagophyll, i, 67, 389.
β-Medicagophyll, i, 389.
Mediterranean, Eastern, water and sea-bottom deposits of the, ii, 51.
Melitriose, estimation of, ii, 425.
—— properties of, ii, 425.
Mellitic acid, etherification of, i, 471.
—— —— formation of, from sugar, i, 164.
—— —— m. p. of, ii, 379.
Melting and boiling points and solubility, change of, ii, 107.
—— point determinations at a red heat, ii, 36.
—— points of difficultly fusible organic compounds, ii, 378.
—— —— of mixtures, Trans., 327.
—— —— of mixtures of isomorphous salts, ii, 36.
—— —— of some inorganic salts, ii, 339.
—— —— of the elements as a clue to their genesis, ii, 340.
Memorial Lecture — Jean Charles Galissard de Marignac, Trans., 468.
Menthene, derivatives of, i, 549.
Menthol, derivatives of, i, 549.

Menthone, chloro-, i, 549.
—— physical properties of, i, 673.
Menthonebisnitrosylic acid, i, 549.
Menthylic bromide, i, 549.
Mercaptides, action of halogen alkylene compounds on, i, 286.
Mercapturic acids, synthesis of, i, 284.
Mercuric arsenite, ii, 218.
—— bromide, heat of formation of, ii, 305.
—— —— hydrolysis of aqueous solutions of, ii, 393.
—— chloride and hydrogen sulphide, reaction of, in the gaseous state, ii, 225.
—— —— estimation of, ii, 140.
—— —— hydrolysis of aqueous solutions of, ii, 393.
—— —— stability of aqueous solutions of, ii, 46.
—— —— volatility of, ii, 15.
—— cyanide, compounds of, with dichromates, ii, 355, 356.
—— diammonium chloride, ii, 11.
—— formamide, i, 9.
—— iodide, heat of formation of, ii, 305.
—— —— solubility of, in carbon bisulphide at low temperatures, ii, 489.
—— β-naphthoxide, i, 86.
—— —— acetate, i, 86.
—— —— chloride, i, 86.
—— nitrates, heats of dissolution and formation of, ii, 154.
—— oxide, heat of formation of, ii, 305.
—— oxides, thermochemistry of, ii, 305.
—— oximidocarbonate, i, 3.
—— oxychlorides, ii, 393.
—— perchlorate, Trans., 1013.
—— phenoxide acetate, i, 87.
—— —— chloride, i, 87.
—— —— hydroxide, i, 87.
—— picrate, preparation and thermochemistry of, i, 131.
—— silver cyanonitrates, i, 581.
—— sulphates, thermochemistry of, ii, 103.
—— sulphide, conversion of the black into the red modification, and the density and specific heat of the two forms, ii, 110.
—— —— thermal changes accompanying the isomeric changes of, ii, 435.
—— thiophosphate, ii, 13.
p-Mercurioacetanilide, i, 358.
Mercurioacetanilides, i, 358.
p-Mercurioaniline bromide, i, 358.
—— iodide, i, 358.
p-Mercuriodiethylaniline, bromide and iodide, i, 359.
Mercuriodimethylaniline bromide and iodide, i, 358.
p-Mercuriodiphenylenediacetylmercuriodiammonium salts, i, 357, 358.
p-Mercurioethylaniline iodide, i, 359.
p-Mercuriomethylaniline bromide, i, 358.
Mercuriothiophen sulphate, basic, i, 411.
Mercurous arsenite, ii, 218.
—— chloride, molecular weight of, ii, 447.
—— —— vapour, molecular state of, ii, 46, 166, 225.
—— nitrate hypophosphite, Trans., 227.
—— oxide, heats of formation of, ii, 381.
—— perchlorate, Trans., 1016.
—— salts, heat of formation of, ii, 380, 381.
Mercury, action of, on fused ammonium salts, Proc., **1895**, 114.
—— and silver, double salts of, containing cyanogen, i, 581.
—— compounds of the aromatic series, i, 368.
—— compounds of thiophen, i, 411.
—— estimation of, in presence of iodine, ii, 87.
—— heat of combination of, with the halogens and oxygen, ii, 380.
—— hypophosphites, Trans., 227.
—— separation of antimony from, ii, 532.
—— separation of arsenic from, ii, 532.
—— separation of bismuth from, ii, 332, 532.
—— separation of cadmium from, ii, 532.
—— separation of copper from, ii, 532.
—— separation of lead from, ii, 332, 532.
—— separation of manganese from, ii, 332.
—— separation of the metals of the arsenic and copper groups from, ii, 532.
—— separation of tin from, ii, 532.
Mercuryacetylcarbamide, i, 270.
Mercury-ψ-cumyl salts, i, 368.
Mercurycymyl salts, i, 368.
Mercurydi-ψ-cumyl, i, 368.
Mercurydimesityl, i, 368.
Mercurydiphenylenephenyl, i, 368.
Mercurydi-*m*-tolyl, i, 368.
Mercuryformylcarbamide, i, 270.
Mercurymesityl salts, i, 368.
Mercury-*m*-tolyl salts, i, 368.
Mesityl oxide, action of ethylenediamine on, i, 328.
—— —— action of hydrogen peroxide on, i, 644.

Mesorcinol, i, 299.
Mesoxalamide, hydrazone, Trans., 1003.
—— nitrophenylhydrazone, Trans., 1004.
—— phenylhydrazone, Trans., 1003.
Metabolism, ii, 78.
—— and absorption in obstruction of the pancreatic duct, ii, 454.
—— in diabetes, ii, 406.
—— influence of fat and starch on, ii, 516.
—— influence of the division of food into rations on, ii, 78.
—— influence of the thyroid gland on, ii, 516.
—— nitrogenous, ii, 359.
—— of carbohydrates and the liver, ii, 360.
—— plant, place of tannins in, ii, 324.
Metacopaivic acid, i, 384.
Metacholestol, i, 384.
Metallic bases, constitution of, ii, 499.
Metallolites, ii, 23.
Metals, action of nitric acid on, Trans., 1151.
—— action of nitric oxide on, at high temperatures, ii, 11.
—— and electrolytes, potential differences between, ii, 35.
—— and their oxides, action of nitrous oxide on, ii, 312.
—— fluidity of, at temperatures below their melting points, ii, 37.
—— method for determining the thermal conductivity of, ii, 69.
—— molecular complexity of, in the liquid and solid states, Trans., 1162.
—— molten, certain regularities in the weights of drops of, ii, 161, 203.
—— pure, thermoelectric properties of, ii, 99.
—— separation of, in alkaline solution by hydrogen peroxide, ii, 331.
Metanicotine, i, 116, 309.
—— action of bromine on, i, 116.
Metapectin, i, 8.
Metapropaldehyde, i, 200.
Metastannic acid, ii, 448.
Meteoric iron, estimation and detection of selenium in, ii, 369.
—— —— of Verchne-Udinsk, Siberia, ii, 402.
Meteorite of Cañon Diablo, ii, 319.
—— of Netschaëvo (Tula), silicates of the, ii, 402.
—— of Plymouth, Indiana, ii, 320.
Methæmoglobin, i, 256.
Methane, critical density of, ii, 379.
—— nitro-, explosiveness of sodium and potassium, i, 123.
Methanehydrazomethane, i, 262.
Methenic acids, i, 648.
Methenylcarbohydrazine, i, 12.
Methinic acids, i, 648.
Methoxyacetophenone, i, 44.
m-Methoxyacetophenone, i, 114.
m-Methoxyanthranil, i, 525.
o-Methoxybenzamide, i, 213.
m-Methoxybenzoic acid, dry distillation of the calcium salt of, i, 366.
o-Methoxybenzoic chloride, i, 213.
m-Methoxybenzoylacetone and its phenylimide, i, 114.
p-Methoxybenzylamidoacetal, i, 89.
p-Methoxybenzylamidoacetaldehyde, i, 89.
—— phenylhydrazone, i, 89.
m-Methoxybenzylideneamidoacetal, i, 624.
p-Methoxybenzylideneamidoacetal, i, 89.
o-Methoxy-*m*-*iso*-butylacetophenone, i, 289.
o-Methoxy-*p*-*iso*-butylbenzaldehyde, i, 222.
o-Methoxy-*p*-*iso*-butylbenzophenone, i, 290.
m-Methoxycoumarin-β-carboxylic acid, i, 420.
5 : 3 : 4 : 1-Methoxydimethylphenylpyrazole, i, 397.
Methoxydiphenylenepyrodiazoline (?), i, 213
2 : 2′-Methoxyethyltetrahydro-*iso*-quinoline, i, 616, 626.
p-Methoxyhippuraldehyde, i, 90.
—— phenylhydrazone, i, 90.
p-Methoxyhippuric acid, *m*-bromo-, i, 90.
4-Methoxy-2-hydroxybenzoic acid, Trans., 994.
Methoxymethylenecamphor, i, 64.
Methoxymethylenementhone, i, 65.
5 : 3 : 1-Methoxymethylphenylpyrazole, i, 397.
p-Methoxy-1′-methyl-2′-quinolone-4′-carboxylic acid, i, 156.
2 : 2′-Methoxymethyltetrahydro-*iso*-quinoline, i, 616.
2 : 1′-Methoxynaphthalenesulphonamide, Proc., **1895**, 50.
2 : 3′-Methoxynaphthalenesulphonamide, Proc., **1895**, 50.
2 : 1′-Methoxynaphthalenesulphonanilide, Proc., **1895**, 50.
2 : 3′-Methoxynaphthalenesulphonanilide, Proc., **1895**, 50.
2 : 1′-Methoxynaphthalenesulphonic chloride, Proc., **1895**, 50.
2 : 3′-Methoxynaphthalenesulphonic chloride, Proc., **1895**, 50.
2-Methoxy-1 : 4-naphthaquinone, iodo-, i, 237.
αβ-Methoxynaphthoic acid, i, 367.
6-Methoxyphenopyridazole, i, 302.
3-Methoxy-2′-phenylcinchoninic acid and its derivatives, i, 114.

3-Methoxy-2′-phenylcinchoninic acid, methochloride and methylbetaïne of, i, 114.
3 : 4′-Methoxyphenylquinaldine, i, 431.
2-Methoxy-*iso*-quinoline, i, 624.
—— ethiodide, i, 625.
—— methiodide, i, 625.
Methoxysuccinic acids, optically active, Trans., 944.
—— —— —— —— ethereal salts of, Trans., 957.
d-Methoxysuccinic acid, Trans., 949.
l-Methoxysuccinic acid, Trans., 949.
i-Methoxysuccinic acid, resolution of, into its optically active components, Trans., 944, 959.
2-Methoxytetrahydro-*iso*-quinoline, i, 626.
Methyl amidobutyl ketone, salts of, i, 685.
—— amidoethyl ketone, i, 685.
—— amyl diketone, preparation of, i, 499.
—— —— diketoxime, i, 499.
—— benzenesulphamidobutyl ketone, i, 686.
—— butyl ketone, oxidation of, i, 499.
—— *iso*-butylidene ketoxime, i, 646.
—— α-dichlorobutyl ketone, i, 497.
—— α-dichloroethyl ketone, i, 497.
—— α-dichloropropyl ketone, i, 497.
—— ethyl diketone, preparation of, i, 499.
—— —— ketone, action of nitric acid on, i, 201.
—— —— —— *iso*-nitroso-, i, 499.
—— —— —— oxidation of, i, 499.
—— group, influence of, on the properties of nitro-groups, i, 654.
—— hexyl ketone, i, 203.
—— —— —— oxidation of, i, 499.
—— *o*-hydroxydihydrostyryl ketone, i, 280.
—— 6 : 3-nitrobromophenylhydroxyethyl ketone, i, 282.
—— *iso*-nitrosopropyl ketone, reduction products of, i, 498.
—— octyl diketone, i, 15.
—— —— —— monoxime of, i, 15.
—— —— —— phenylhydrazone of, i, 15.
—— —— —— phenylhydrazoxime of, i, 15.
—— —— diketoxime, i, 15.
—— phenyl ketone, reduction of, by sodium ethoxide, i, 601.
—— picolyl ketone, i, 564.
—— propyl diketone, preparation of, i, 499.
—— —— ketone, oxidation of, i, 499.
—— *iso*-propylidenepropyl ketone, i, 646.
Methylaceturic acid, i, 176.
α-Methyladipic acid, Trans., 115 ; i, 78.
α-Methyladipic acid, salts of, Trans., 116.
β-Methyladipic acid, i, 448.
Methylamidocaffeïne, i, 116.
Methylamidocollidine, i, 562.
2-Methylamido-4 : 5-diphenyldihydro-1 : 3-azothiole, i, 597.
2-Methylamido-4 : 5-diphenyldihydro-1 : 3-azoxole, i, 597.
Methyl-*p*-amidophenylcarbinol, i, 178.
2′-Methylamidoquinoline methiodide, i, 156.
—— methochloride, i, 156.
α-Methyl-μ-amidothiazole-β-acetic acid, i, 495.
α-Methyl-δ-amidovaleraldehyde, i, 479.
Methylamine, action of, on phenanthraquinone, Trans., 45.
—— dichloro-, i, 494.
—— methylthiocarbamate, i, 577.
Methylanilidomethylenecamphor, i, 63.
Methylanilidomethylenepropyl phenyl ketone, i, 65.
Methylaniline, dinitro-, reduction of, i, 514.
Methylanishydroxamic acid, i, 38.
Methylated spirit, detection of, in tinctures, &c., ii, 91.
Methylbenzhydroxamic acid, i, 38.
m-Methylbenzoyl-*o*-uramide, derivatives of, i, 524.
Methyl-*iso*-butylacetamide, Trans., 511.
Methyl-*iso*-butylacetanilide, Trans., 512.
Methyl-*iso*-butylacetic acid, Trans., 509, 511.
—— chloride, Trans., 511.
Methyl-*iso*-butylacet-*p*-toluidide, Trans., 512.
Methylbutylidene ethyl ketone, i, 645.
Methyl-*iso*-butylmalonic acid, Trans., 510.
α-Methylbutylnitramine, i, 589.
β-Methylbutylnitramine, i, 589.
α-Methyl-*iso*-butylnitramine, i, 589.
β-Methyl-*iso*-butylnitramine, i, 589.
α-Methylbutyrolactone, synthesis of, Proc., **1895**, 40.
α-Methylbutyrolactonecarboxylate, i, 171.
Methylcamphorimine hydriodide, i, 426.
β-Methylcoumaric acid, polymerisation of, i, 279.
Methylcytisine, salts of, i, 159.
o-Methyldiazoamidobenzene, *p*-nitro-, i, 216.
o-Methyldiazobenzene ethyl ether, *p*-nitro-, i, 216.
—— methyl ether, *p*-nitro-, i, 216.
Methyldibenzyl ketone, i, 375.
—— —— phenylhydrazone, i, 375.
μ-Methyl-*n*-diethyldiphenylimidazolonium iodide, Trans., 44.

1′-Methyldihydrocinchonic acid, i, 155.
Methyldihydrocoumaroketone, i, 280.
Methyldihydro-β-phenotriazine, salts of, i, 306.
Methyldihydrophthalazine, i, 568.
—— methiodide, i, 569.
3-Methyl-5-dimethylpyrazoline, i, 249.
Methyl-*m*-dinitrodiphenylcyanidine, i, 266.
2-Methyldiphenyl, 4-nitro-, i, 289.
4-Methyldiphenyl, 4′-nitro-, i, 182.
Methyldiphenylamine, oxidation of, by incomplete combustion, i, 272.
2 : 4 : 5-Methyldiphenyldihydroglyoxaline, i, 567.
n-Methyldiphenyleneimidazole, Trans., 46.
Methylemetonium hydroxide, i, 118.
Methylene-blue, difficulty in the detection of chlorine in, ii, 182.
—— distribution of, between water and mercerised cellulose, i, 668.
—— electrolytical conductivity of, i, 540.
Methylenecaffeïc piperidide, i, 469.
Methylenecamphor, amido-, i, 63.
—— bromo-, i, 63.
—— chloro-, i, 63.
—— imido-, i, 63.
Methylenecamphorcarboxylic acid, i, 65.
Methylenecinchoxinic acid, i, 156.
Methylenediantipyrine, i, 482.
p-Methylenedihydrobenzoic acids, isomeric, i, 92.
Methylenediorcinyl, i, 46.
Methylenedioxyanthranil, i, 525.
Methylenedioxyanthranilic acid, i, 525.
2 : 3-Methylenedioxy-2′-methyltetrahydro-*iso*-quinoline, i, 626.
2 : 3-Methylenedioxy-*iso*-quinoline, i, 625.
—— methiodide, i, 625.
Methylenic chloride, action of ammonia on, i, 262.
—— chlorobromide, action of ammonia on, i, 262,
—— diphenylic ether, Proc., 1895, 40.
—— lactate, i, 332.
Methylenitan, non-identity of, with formose, i, 164.
Methylethylacetic acid, i, 119.
Methylethylacraldehyde, condensation of, with acetone, i, 644.
γ-Methylethylaticonic acid, i, 143.
μ-Methyl-*n*-ethyldiphenylimidazole, Trans., 43.
Methylethyldithiourazole, i, 402.
Methylethylfurazan, i, 192.
4 : 1-Methylethylglyoxalidine, i, 482.
Methyl-3′-ethyl-3-heptanon-6-olide-1-3′-, i, 548.
γ-Methylethylitaconic acid, i, 143.
Methylethylnitramine, i, 455.
Methylethyl-*iso*-oxazoline, nitro-, i, 684.
μ-Methylethylparaconic acid, i, 143.
—— —— bromo-, i, 143.
ββ-Methylethylpropionamide, Trans., 267.
ββ-Methylethylpropionanilide, Trans., 268.
ββ-Methylethylpropionic acid, Trans., 264, 267.
ββ-Methylethylpropion-*o*-toluidide, Trans., 268.
Methylethylprotocatechuic acid, dibromo-, i, 656.
1 : 3-Methylethylthiotetrahydroquinazoline, i, 307.
δ-Methyl-α-ethylvaleraldehye, δ-amido-, i, 683.
iso-Methyleugenol, action of nitrous acid on, i, 35.
—— nitrosite, i, 36.
—— peroxide, bromo-, i, 35.
—— —— diisonitroso-, isomeride of, i, 36.
—— —— diisonitrosonitro-, i, 35.
iso-Methyleugenoldioxime, i, 36.
Methylfructoside, i, 440.
Methylfumaramic acid, i, 591.
Methylfurazancarboxylic acid, i, 192.
α-Methylgalactoside, i, 439.
β-Methylgalactoside, i, 439.
—— action of emulsin on, i, 441.
Methylglucoheptoside, i, 439.
Methylglucoside, the second, i, 5.
α-Methyl-*d*-glucoside, i, 437, 439.
—— oxidation of, i, 587.
α-Methyl-*l*-glucoside, i, 439.
β-Methyl-*d*-glucoside, i, 439.
β-Methyl-*l*-glucoside, i, 439.
Methylglyoxalidine, i, 73.
4-Methylglyoxalidine, i, 482.
Methyl-green, action of bromine on, i, 56.
Methylheptenone, natural, i, 646.
Methylhexamethylenecarboxylic acid, Trans., 125.
p-Methylhexaresorcinolsulphophthaleïn, i, 184.
Methylhexylcarbinol, i, 203.
—— action of chlorine on, i, 260.
Methylhippuric acid, i, 176.
Methylhydrazicarbimine, i, 30.
3-Methyl-1-*p*-hydroxyphenyl-5-pyrazolone, i, 398.
Methylhydroxydiphenylethylthiocarbamide, i, 597.
Methylic acetate, molecular surface energy of, ii, 40.
—— acetoxymethylenephenylacetate, i, 65.
—— acetylenedicarboxylate, action of sulphur on, i, 510.

Methylic acetylmalate, rotatory power of, ii, 251.
—— acetylsarcolactate, Proc., **1895**, 54.
—— alantolate, i, 555.
—— alcohol, action of boron fluoride on, i, 452.
—— —— action of bromine on, i, 637.
—— —— action of chlorine on, i, 637.
—— —— action of iodine on, i, 637.
—— —— action of magnesium and of iron on, i, 405.
—— —— and ethylic ether, osmotic phenomena between, with different diaphragms, ii, 487.
—— —— molecular complexity of, ii, 41.
—— —— oxidation of, with Fehling's solution, i, 198.
—— —— velocity of etherification of, ii, 258.
—— amidoanilidomethoxyacetate, i, 170.
—— amidoanilido-oxalate, i, 170.
—— *p*-amidotoluate, i, 365.
—— amylacetate, i, 203.
—— amylic ether, chloro-, i, 14.
—— —— —— b. p., sp. gr., and rotatory power of, i, 318.
—— anhydrocamphoronate, i, 242.
—— β-anilidobenzylmalonate, i, 228.
—— aniline β-anilidobenzylmalonate, i, 227.
—— anisbenzhydroxamates, i, 40.
—— anthracene-β-sulphonate, i, 671.
—— anthraquinone-β-sulphonate, i, 671.
—— benzhydroxamate, i, 37.
—— benzophenonedicarboxylate, i, 422.
—— β-benzoyl-α-phenylpropionate, i, 361.
—— benz-*p*-toluhydroxamates, i, 40
—— benzylidenemalonate, action of aniline and of phenylhydrazine on, i, 227.
—— borate, i, 452.
—— bromanhydrocamphoronate, i, 242.
—— *o*-bromobenzoate, Trans., 590.
—— *p*-bromobenzoate, Trans., 591; i, 150, 218.
—— bromo-*m*-diphenylcarboxylate, i, 149.
—— bromopropionate, Trans., 920.
—— α-bromopropionate, i, 16, 169.
—— —— action of, on sodium nitrite, i, 169.
—— *d*-bromosuccinate, i, 451.
—— butylcarbamate, i, 588.
—— *iso*-butylcarbamate, i, 588.
—— *sec*-butylcarbamate, i, 588.
—— *tert*-butylcarbamate, i, 588.
—— *iso*-butylic oxide, chloro-, i, 14.
—— butylnitrocarbamate, i, 588.
Methylic *iso*-butylnitrocarbamate, i, 588.
—— *sec*-butylnitrocarbamate, i, 588.
—— *p*-*iso*-butylphenylic ether, action of acid chlorides on, i, 289.
—— butyrate, molecular surface energy of, ii, 40.
—— *iso*-butyrate, molecular surface energy of, ii, 40.
—— caffeïnecarboxylate, i, 629.
—— campholate, i, 295.
—— *iso*-campholate, i, 62.
—— camphoronate, i, 242, 243.
—— catechol dicarbonate, i, 603.
—— chloride, hydrate of, ii, 44.
—— —— identity of, with menthene hydrochloride, i, 549.
—— β-chloro-αα-ketoindenecarboxylic acid, i, 231.
—— chloronicotinate, i, 244.
—— *d*-chloropropionate, i, 451.
—— *l*-chloropropionate, Trans., 919.
—— *d*-chlorosuccinate, i, 450.
—— cinnamate dichloride, i, 664.
—— β-cresotate, acid derived from, i, 366.
—— cyanacetoacetate, compound of, with phenylhydrazine, i, 648.
—— cyanobutyrylacetate, i, 649.
—— cyano-*iso*-butyrylacetate, i, 649.
—— cyanopropionylacetate, i, 649.
—— diacetyltartrate, i, 173.
—— dianilidomethoxyacetate, i, 170.
—— dianilido-oxalate, i, 170.
—— dianishydroxamates, i, 40.
—— dibenzhydroxamates, i, 39.
—— dibenzoyltartrate, i, 268.
—— 2 : 4-dibromobenzoate, Trans., 592.
—— 2 : 6-dibromobenzoate, Trans., 595.
—— 3 : 5-dibromobenzoate, Trans., 594.
—— dibutyryltartrate, i, 174.
—— di-*iso*-butyryltartrate, i, 211.
—— dicaproyltartrate, i, 175.
—— *iso*-dichlorosuccinate, i, 19.
—— diethylic ethanetetracarboxylate, Trans., 774.
—— dihydrofluoranate, i, 291.
—— dihydrogen camphoronate, i, 242.
—— —— ethanetetracarboxylate, Trans., 771.
—— dihydroxystearate, i, 501.
—— γφ-diketosebate, i, 335.
—— 2 : 6-dinitrobenzoate, Trans., 599.
—— 3 : 5-dinitrobenzoate, i, 365.
—— dinitrosolactate, i, 169.
—— diphenylacetyltartrate, i, 268.
—— dipiperidomethoxyacetate, i, 170.
—— dipiperido-oxalate, i, 170.
—— dipotassium ethanetetracarboxylate, electrolysis of, Trans., 772.

Methylic dipropionyltartrate, i, 174.
—— di-*p*-toluidomethoxyacetate, i, 170.
—— di-*p*-toluido-oxalate, i, 170.
—— *di-p*-toluoyltartrate, i, 268.
—— divaleryltartrate, i, 174.
—— di-*iso*-valeryltartrate, i, 211.
—— ethanetetracarboxylate, Trans., 770.
—— ether, chloro-, i, 14.
—— —— and boron fluoride, molecular compound of, i, 452.
—— *d*-ethoxysuccinate, Trans., 971.
—— *l*-ethoxysuccinate, Trans., 972.
—— ethylic ether, chloro-, i, 14.
—— ethylpulvate, i, 101.
—— ethyl-*p*-toluhydroxamate, i, 39.
—— β-ethyl-*p*-toluo-*m*-diazine-α-carboxylate, i, 399.
—— formate, molecular surface energy of, ii, 40.
—— formylsuccinate hydrazone-dihydrazide, i, 128.
—— —— hydrazone-hydrazide, i, 128.
—— hemipinates, i, 421.
—— hexahydro-*p*-phenylbenzoic acid, i, 97.
—— hydrogen camphoronate, i, 242, 243.
—— —— sulphocamphylate, i, 154.
—— 2 : 6-hydroxydiphenylcarboxylic acid, i, 373.
—— hydroxymethylenephenylacetate, i, 65.
—— 3-hydroxy-2′-phenylcinchoninate, i, 115.
—— hydroxypentadecoate, i, 119.
—— iodide and ethylic sulphide velocity of reaction between, ii, 8.
—— *l*-lactate, Trans., 916.
—— maleate, rotatory power of, ii, 251.
—— mercuridiazoacetate, i, 203.
—— *m*-methoxybenzoate, i, 366.
—— 3-methoxycinchoninate, i, 115.
—— *m*-methoxycoumarin-β-carboxylate, i, 420.
—— 3-methoxy-2′-phenylcinchoninate, i, 115.
—— *d*-methoxysuccinate, Trans., 970.
—— β-methyladipate, i, 448.
—— methylbenzhydroxamate, i, 38.
—— methylenecamphorcarboxylate, i, 65.
—— methylenequinaldinium-β-carboxylate, i, 113.
—— methylfumaramate, i, 591.
—— methylmalate, ii, 98.
—— methylresorcylate methyl ether, Trans., 994.
—— β-methyl-*p*-toluo-*m*-diazine-α-carboxylate, i, 399.
—— 1 : 2-naphthaquinone-4-anthranilate, i, 107.
Methylic 3 : 5-nitramidobenzoate, i, 365.
—— *o*-nitrobenzoate, i, 276.
—— α-nitrosobutyrate, i, 330.
—— α-nitrosopropionate, i, 169.
—— 3 : 5-nitrothionylamidobenzoate, i, 365.
—— *p*-nitrotoluate, i, 365.
—— orcinol dicarbonate, i, 603.
—— oxalyldibenzyl ketone, i, 375.
—— pheno-3-pyridazolonecarboxylate, i, 303.
—— 2′-phenylcinchoninate, i, 115.
—— β-phenylhydrazidobenzylmalonate, i, 228.
—— phenylimidomethoxyacetate, i, 170.
—— phenyl-*m*-nitrocinnamates, isomeric, i, 532.
—— phenyl-*o*-nitrocinnamates, isomeric, i, 531.
—— phenyl-*p*-nitrocinnamates, isomeric, i, 532.
—— propionate, molecular surface energy of, ii, 40.
—— propylic ether, chloro-, i, 14.
—— propylvulpate, i, 101.
—— pulvamate, i, 101.
—— pyrogallol dicarbonate, i, 603.
—— quinaldine-β-carboxylate and its alkyl-haloïd derivatives, i, 112.
—— quinol dicarbonate, i, 603.
—— quinoline-1-sulphonate, i, 111.
—— α-quinoquinolone-β-carboxylate, i, 244.
—— resorcinylic dicarbonate, i, 603.
—— salicylate in indigenous plants, ii, 177.
—— sarcolactate, Proc., 1895, 54.
—— semiorthoxamate, i, 170.
—— semiphenylimido-oxalate, i, 170.
—— sulphocamphylate, i, 154.
—— 2 : 3 : 4 : 6-tetrabromobenzoate, Trans., 599.
—— tetrachloroxyhydrindenecarboxylate, i, 231.
—— *p*-thionylamidotoluate, i, 365.
—— thiophentetracarboxylate, i, 510.
—— thiosulphite, i, 258.
—— 2 : 4 : 6-tribromobenzoate, Trans., 597.
—— 3 : 4 : 5-tribromobenzoate, Trans., 596.
—— triethylic ethanetetracarboxylate, Trans., 773.
—— *cis*-1 : 2-*trans*-1 : 3-trimethylenetetracarboxylate, i, 269.
—— *trans*-1 : 2 : 3-trimethylenetricarboxylate, i, 269.
—— 2 : 4 : 6-trinitrobenzoate, Trans., 600.
—— vulpate, i, 101.
—— γ-trinitronaphthylic ether, i, 235.
—— δ-trinitronaphthylic ether, i, 236.

Methylimidobenzoylformic acid, i, 9.
Methylindene, condensation of, with benzaldehyde, i, 535.
1″-Methylindolesulphonic acid, sodium salt of, i, 145.
Methyllevuloside, i, 440.
Methyllysidine, i, 73.
Methylmetanicotine methiodide, i, 309.
1-Methyl-2-methylimido-5-thio-3 : 4-dithiazolidine, i, 577.
—— tribromo-, i, 577.
Methylmenthone, i, 65.
Methylnaphthalimide, i, 239.
Methylnaphthaloxime, i, 240.
α-Methylnaphthylamine, *α*-nitroso-, i, 598.
Methylnitramine, i, 445.
Methyl-*o*-nitrobenzylaniline, i, 354.
Methyloctadienone, i, 644.
p-Methyloctoresorcinolsulphophthaleïn, i, 184.
Methyl-orange and litmus as indicators, ii, 134, 242, 325.
Methyloxalyldibenzyl ketone, i, 375.
Methyl-*iso*-oxazolenimide phenylhydrazone, i, 583.
Methyl-*iso*-oxazolone, nitro-, i, 684.
—— —— bromo-derivatives of, i, 685.
1″-Methyloxindole, i, 145.
μ-Methylphenopenthiazole, i, 191.
μ-Methylphenopentoxazole, i, 191.
1-Methylphenopyridazolone, i, 302.
α-Methyl-*γ*-phenoxyethylmalonic acid, Proc., 1895, 40.
γ-Methylphenylaconic acid, i, 142.
Methylphenylaticonic acid, i, 143.
3 : 1 : 4-Methylphenylbenzenazopyrazolone, i, 395.
ab-Methylphenylbenzylcarbamide, Trans., 563.
ab-Methylphenylbenzylurea, Trans., 563.
ab-Methylphenylcarbamide, Trans., 561.
Methylphenylcarbinol, *p*-amido, i, 177.
Methylphenylcyanothiocarbamide, i, 462.
Methylphenyldithiobiuret, i, 418.
—— condensation of, with aldehydes and ketones, i, 418.
α-Methylphenyldithiodimethylketuret, i, 418.
α-Methylphenyldithiophenylalduret, i, 418.
Methylphenylfluorindine, i, 526.
γ-Methylphenylitaconic acid, i, 142.
3 : 1-Methylphenyl-4-keto-6 : 5-pyrazolone hydrazone, i, 398.
3 : 5-Methylphenyl-Δ_2-ketotetrahydrobenzene, i, 50.
Methylphenylmalonic acid, i, 368.
Methylphenyl-*iso*-oxazole, i, 529.
γ-Methylphenylparaconic acid, i, 142.
—— —— *β*-bromo-, i, 142.
1-Methyl-3-phenylphenopyridazolone, i, 303.
2 : 6-Methylphenylpiperidine, i, 563.
1-Methylphenylpyrazole, i, 396.
Methylphenylpyrazolone, electrolysis of, i, 209.
1 : 3-Methylphenyl-2-pyrazolone, i, 687.
4 : 3-Methylphenyl-2-pyrazolone, i, 687.
3 : 1-Methylphenyl-2-pyrazolone-3-carboxylic acid, i, 432.
2 : 6-Methylphenylpyridine, i, 562.
1′ : 4′-Methylphenylquinolone, i, 430.
p-Methylphenylsulphophthaleïn, i, 183.
Methylphenyltetrahydroketotriazine, i, 460.
Methylphenyltetrahydroquinoline, i, 431.
Methylphenylthiotetrahydroquinazoline, i, 307.
Methylphenylthiuret, i, 418.
Methylphenyltriazolecarboxylic acid, i, 574.
ab-Methylphenylurea, Trans., 561.
Methylphthalylhydrazide, i, 355.
Methylpiperazine, i, 570.
—— dinitrosamine, i, 570.
α-Methylpiperic acid, i, 468.
Methylpiperidinecarboxylic acid, i, 631.
Methylpiperine, i, 469.
Methylpropylethylene, magnetic rotation of, Trans., 257.
Methylpropylimidazole, i, 686.
Methylpropylimidazolone, i, 686.
Methylpropylimidazolyl hydrosulphide, i, 686.
Methylpropylnitramine, i, 445.
Methyl-*iso*-propylnitramine, i, 445.
Methyl-*iso*-propylnonadienone, i, 644.
Methylpyrazine and its derivatives, i, 569.
1-Methylpyrazole, i, 397.
5-Methylpyrazoline, i, 688.
3-Methylpyrazolone, 4-dibromo-, i, 687.
—— *l*-*iso*-nitroso-, i, 246.
3-Methylpyrazolone-4-azobenzene, i, 687.
3-Methylpyrazolone-1-carboxylamide, i, 252.
3-Methylpyridazinone, i, 247.
3-Methylpyridazolone, i, 247.
2-Methylpyridine, 4-chloro-, Trans., 405.
2-Methyl-6-pyridinecarboxylic acid, 4-chloro-, Trans., 404.
Methylpyromeconic acid, i, 80.
n-Methylpyrrolidine, i, 311.
1-Methylquinoline, physiological action of, ii, 56.
3-Methylquinoline, physiological action of, ii, 56.

2′-Methylquinoline. See Quinaldine.
Methylquinoliniumhydroxidecarboxylic acid, i, 115.
1′-Methyl-2′-quinolone-4′-carboxylic acid, i, 156.
Methylresacetophenone, i, 43.
—— methyl ether, Trans., 996.
—— bromo-, Trans., 997.
Methyl-*β*-resorcylic acid methyl ether, Trans., 994.
Methylrhamnoside, i, 440.
Methylsalicylic acid, dry distillation of the calcium salt of, i, 366.
Methylsorboside, i, 440.
3 : 5-Methylstyryl-Δ_2-ketotetrahydrobenzene, i, 51.
Methylsulphonethylamine, secondary, i, 85.
Methylsulphonethylene barium sulphate, i, 85.
ν-Methyltetrahydroquinoline, i, 480.
Methylthiocarbimide, action of bromine on, i, 576.
3-Methylthiotetrahydroquinazoline, i, 306.
Methyl-*o*-toluidine, oxidation of, by incomplete combustion, i, 272.
Methyl-*p*-toluo-*m*-diazine-*α*-carboxylic acid, i, 398.
β-Methyl-*p*-toluo-*m*-diazine, i, 399.
Methyl-*β*-*m*-tolyl-*αγ*-diketohydrindene, i, 536.
1-Methyl-3-*p*-tolylphenopyridazolone, i, 303.
Methyltriacetonamine, i, 327.
Methyltrimethylene, i, 161.
Methyltripiperidine-*n*-phosphonium hydroxide and salts, i, 682.
Methylxanthine, a product of metabolism of theobromine and caffeïne, i, 434.
α-Methylxyloside, i, 440.
β-Methylxyloside, i, 439.
Microbes, assimilation of free atmospheric nitrogen by, ii, 283.
Microlite from Greenland, ii, 401.
Mignonette root, oil of, i, 218.
Milk, analysis of, ii, 145.
—— citric acid and calcium phosphate in, ii, 122.
—— coagulation of, ii, 122.
—— demonstration of fat in, ii, 122.
—— detection of formaldehyde in, ii, 373.
—— discoloration and coagulation of, by heat, i, 640.
—— estimation, centrifugal, of fat in, ii, 539.
—— estimation of fat in, ii, 95, 298, 299, 373, 539.
—— estimation of fat in, by Soxhlet's method, ii, 95.
—— estimation of the acidity of, ii, 94.
Milk, formaldehyde as a preservative for, ii, 373.
—— freezing point of, as a criterion of purity, ii, 539.
—— gaseous products in, ii, 298.
—— genuine, Bell's analyses of, ii, 189.
—— human, caseïn of, ii, 54.
—— —— gases of, ii, 405.
—— loss of total solids in, on keeping, ii, 95.
—— of the gamoose, Proc., **1895**, 77.
—— preservation of, for analysis, ii, 189.
—— recognition and estimation of sugars added to, ii, 425.
—— sour, analysis of, ii, 247.
Milk-sugar, action of emulsin on, i, 442.
Mineral water. See Water.
Minerals, dimorphous, ii, 49.
—— direct spectrum analysis of, ii, 470.
—— helium, a gaseous constituent of, ii, 498.
—— of the Karakoram Himalayas, ii, 51.
—— spectra of gases obtained from various, ii, 430.
—— synthesis of, by crystallisation from molten metals, ii, 390.
Mixtures, melting points of, Trans., 327.
Môabi seeds, ii, 285.
Molecular symmetry and rotatory power of organic substances, ii, 1.
—— compounds, constitution of, ii, 498.
—— rotation and molecular deviation, ii, 473.
—— solution volume, ii, 70, 209.
—— —— —— use of, in determining molecular weights, ii, 209.
—— symmetry and asymmetry, ii, 489.
—— weight and density of liquid and solid substances, relation between, ii, 307.
—— —— boiling point apparatus for the determination of, ii, 479, 480.
—— —— calculation of, from the reduction of solubility of a solvent, ii, 256.
—— —— determinations by aid of the molecular solution volume, ii, 209.
—— —— —— cryoscopic, ii, 41.
—— —— —— in solid solutions, ii, 439.
—— —— —— of solid, liquid, and dissolved substances, ii, 308.
—— —— of iodine in solution, determination of, ii, 382.
—— —— of liquids, determination of, ii, 99.
—— —— of mercurous chloride, ii, 46 166, 447.
—— weights, determination of, ii, 154, 382.

Molecule, motions of and within the, ii, 481.
Molecules, atoms and ions, ii, 441.
—— liquid, complexity and dissociation of, ii, 40.
Molybdamic acid, ii, 48.
Molybdamide, ii, 48.
Molybdenum, action of nitric oxide and peroxide on, ii, 396.
—— atomic weight of, ii, 356.
—— boride, ii, 502.
—— carbide, ii, 397, 502.
—— estimation of, ii, 535.
—— hexachloride, attempt to prepare, ii, 18.
—— pentachloride and hydrogen sulphide, action of, in the gaseous state, ii, 225.
—— preparation and properties of, ii, 501.
—— presence of, in hæmatite, ii, 505.
—— reduction of ferric chloride by, ii, 398.
—— separation of arsenic from, ii, 416.
—— sesquioxide, action of nitrous oxide on, ii, 312.
Molybdethylamic acid, ii, 48.
Molybdethylamide, ii, 48.
Molybdic acid, estimation, acidimetric, of, ii, 331.
—— anhydride, action of acetylene on, ii, 397.
—— —— action of ethylene on, ii, 397.
—— —— action of phosphine on, ii, 397.
—— —— action of phosphorus pentachloride on, ii, 396.
—— —— and vanadic anhydride, volumetric estimation of, in the same solution, ii, 535.
—— —— reduction of, by aluminium, magnesium, or zinc, ii, 397.
Molybdodiethylamide, ii, 48.
Molybdosulphurous acid, salts of, ii, 18.
Monazite from North Carolina, ii, 319.
—— helium from, Trans., 689.
Monotropa hypopitys, methylic salicylate in, ii, 177.
Morin hydriodide, Trans., 650.
—— hydrobromide, Trans., 649.
—— hydrochloride, Trans., 650.
Morphine, fallacies of the post-mortem test for, ii, 375.
—— test for, ii, 375.
Mucic acid, action of antimonious oxide on the salts of, Trans., 1037.
—— —— action of arsenious anhydride on the salts of, Trans., 1038.
Mucin, detection of, in sputum, ii, 376.
—— in plants, ii, 128.
Mucous membrane of the stomach and intestines, action of, on some bioses and on raffinose, ii, 403.
Muffle furnace, new form of, ii, 260.
Mummy, analysis of bones of a, ii, 456.
Muscle, blood gases of, in rest and activity, ii, 231.
—— exchange of blood gases in, ii, 231, 405.
—— gaseous exchange in isolated, ii, 231.
Muscle-nucleon, i, 314.
Muscular work, sugar as the source of, ii, 233.
Mushrooms, presence of chitin in the cell membrane of, ii, 408.
—— presence of trehalose in, i, 199.
Must, analysis of, ii, 463.
Mustard, utilisation of elementary nitrogen by, ii, 521.
Mycosin, i, 124; ii, 323.
Myosin, colour reaction for, ii, 376.
Myristamide, heat of formation of, ii, 483.
Myristanilide, heat of formation of, ii, 483.
Myrosin, occurrence and roll of, in plants, ii, 178.

N.

Naphtha, Caucasian, occurrence of hexanaphthene in, i, 271.
Naphthadiphenazine, i, 616.
Naphthalanil, i, 239.
Naphthalene and α-naphthol, melting points of mixtures of, Trans., 333.
—— and β-naphthol, melting points of mixtures of, Trans., 333.
—— α-bromo-, reaction of, with aniline and *p*-toluidine, i, 292.
—— α-chloro-, reaction of, with *p*-toluidine, i, 292.
—— constitution of the tri-derivatives of, Proc., 1895, 78, 79, 81, 82, 84.
—— 1 : 4 : 2-dibromonitro-, Trans., 907.
—— homonucleal, tri-derivatives of, Trans., 907.
—— α-nitro-, action of sulphur on, Trans., 640.
—— —— compound of aluminium chloride with, i, 510.
—— —— oxidation of, i, 543,
—— nomenclature of cyclic derivatives of, i, 106.
—— tetrachloride [1 : 2 : 3 : 4], i, 291.
—— γ-tetramido-, hydriodide of [1 : 3 : 1′ : 4′], i, 235.
—— δ-tetramido-, hydriodide [1 : 2 : 1′ : 4′], i, 236.
—— "α-tetranitro-," i, 235.
—— β-tetranitro- [? 1 : 3 : 1′ : 3′], i, 237.
—— γ-tetranitro- [1 : 3 : 1′ : 4′], i, 235.

Naphthalene, δ-tetranitro- [1 : 2 : 1′ : 4′], i, 236.
—— αα-thio-, Trans., 642.
—— trichloro-, of m. p. 75·5°, non-existence of, Proc., **1895**, 83.
—— 1 : 2 : 2′-trichloro-, Proc., **1895**, 80.
—— 1 : 3 : 3′-trichloro-, Proc., **1895**, 81.
—— α-trinitro- [1 : 3 : 4′], i, 236.
—— γ-trinitro- [1 : 4 : 4′], i, 236.
—— δ-trinitro- [1 : 2 : 4′], i, 236.
Naphthalene-ψ-azimidonaphthalene, i, 670.
Naphthalenecarboxylic acids, chloro-, etherification of, i, 228.
Naphthalene-2-diazo-1-oxide, 4-bromo-, Trans., 908.
Naphthalene-3 : 1′-disulphonic acid, 1-nitro-, i, 543.
Naphthalene-2 : 3′-disulphonic chloride, Alen's α-nitro-, the trichloronaphthalene derivable from, Proc., **1895**, 81.
—— —— 4-chloro-, Proc., **1895**, 83.
Naphthalenes, trichloro-, the fourteen isomeric, Proc., **1895**, 84.
Naphthalene-2′-sulphonic chloride, Cleve's 1 : 2-nitrochloro-, the trichloronaphthalene derivable from, Proc., **1895**, 79.
Naphthalenesulphonic chlorides, formation of chloronaphthalenes from, Proc., **1895**, 86.
Naphthalhydroxamic acid, i, 239.
Naphthalic acid, derivatives of, i, 239.
"Naphthalic acid," iodo-, derivatives of, i, 237.
Naphthaloxime, i, 239.
Naphthalphenylhydrazone, i, 240.
Naphthaphenazine, αβ-dichloro-, i, 615.
Naphthaphenazinequinone, i, 616.
1 : 2-Naphthaquinol, 4-amido-, i, 151.
—— diacetate, chlor-, i, 57.
1 : 4-Naphthaquinol, 2-amido-, i, 151.
1 : 2-Naphthaquinone, i, 105.
—— dibromide, i, 57.
—— dichloride, i, 56.
—— ureide from, i, 425.
1 : 4-Naphthaquinone, 2-amido-, i, 151.
—— bromo-, i, 56.
—— dibromide, i, 56.
—— dichloride, i, 56.
—— 2 : 3-dichloro-, i, 291.
—— iodo-2-amido-, i, 237.
1 : 2-Naphthaquinone-3 : 4-acridone, i, 107.
1 : 2-Naphthaquinone-4-anthranilic acid, i, 107.
—— —— azine from, i, 107.
Naphthaquinonebenzoylamidoanilide, i, 245.
1 : 4-Naphthaquinonephenylimide, i, 601.
1 : 4-Naphthaquinonimide, 2-amido-action of water on, i, 151.
Naphthazarin, i, 150, 477, 613.
—— chloro-, i, 613.
—— dichloride, i, 613.
—— identity of, with 1′ : 2′-dihydroxy-1 : 4-naphthaquinone, i, 151.
—— preparation of, from 1 : 2 : 1′ : 4′-tetranitronaphthalene, i, 668.
—— tetrachloro-, i, 614.
Naphthenes, synthesis of, i, 339.
Naphtheurhodole, β-chloro-, i, 615.
—— from tetrachloronaphthazarin, i, 615.
—— from tetrachlorotetraketotetrahydronaphthalene, i, 615.
Naphthindone, Nt_2-4-amido-, i, 612.
1-Naphthoamide, 4-amido-, i, 670.
—— 4-nitro-, i, 670.
Naphthocyamic acid, formation of, i, 150.
1-Naphthoic acid, 4-amido-, i, 670.
—— —— 4-chloro-, i, 670.
—— —— 4-nitro-, i, 670.
—— —— para-substituted derivatives of, i, 670.
α-Naphthol, action of diazobenzene chloride on, i, 618.
—— and naphthalene, melting points of mixtures of, Trans., 333.
—— and β-naphthol, melting points of mixtures of, Trans., 332.
—— 1′ : 2′-dichloro-, Proc., **1895**, 78.
—— 2′ : 3′-dichloro-, Proc., **1895**, 79.
—— 3 : 4-dichloro-, i, 292.
—— 4 : 2-iodonitro-, Trans., 913.
β-Naphthol, 4-amido-, i, 668.
—— and naphthalene, melting points of mixtures of, Trans., 333.
—— and α-naphthol, melting points of mixtures of, Trans., 332.
—— molecular weight of, in a solid solution, ii, 439.
—— thio-derivatives of, i, 103, 150, 237.
α-Naphtholazo-*p*-benzylic sulphide, i, 457.
β-Naphtholazo-*p*-benzylic sulphide, i, 457.
α-Naphtholcarbothionylic acid, preparation of, i, 378.
1-Naphthol-2 : 4′-disulphonic acid, 4-amido-, i, 543.
—— —— 4-nitroso-, i, 543.
α-Naphthols, dichloro-, from dichlorophenyl-*iso*-crotonic acid, Proc., **1895**, 78.
2-naphtholsulphonic acids, 1-amido-, i, 106.
1 : 4-Naphtholsulphonic acid, preparation of, i, 151.
1-Naphthonitrile, 4-amido-, i, 670.
—— 4-chloro-, i, 670.
—— 4-nitro-, i, 670.

Naphthophenoxazime, i, 245.
Naphthophenoxazine-*o*-hydroxyanilide, i, 245.
Naphthophenoxazone, i, 245.
—— chloro-, i, 245.
Naphthoresorufin, i, 246.
Naphthoresorufinsulphonic acid, i, 246.
Naphthoxanthone, i, 107.
β-Naphthylamidohydroxydiketotetrahydronaphthalene, i, 616.
α-Naphthylamidohydroxy-α-naphthaquinone, i, 616.
—— tetrabromo-, i, 616.
β-Naphthylamidohydroxy-α-naphthaquinone, i, 616.
α-Naphthylamine, action of *p*-nitrophenylazomethylaniline on, i, 618.
—— citrate, i, 106.
—— condensation of glyoxylic acid with, i, 171.
—— derivatives of, i, 106.
—— hydrogen tartrate, i, 106.
β-Naphthylamine, 1 : 4-dibromo-, Trans., 907.
—— —— action of nitrous acid on, Trans., 908.
—— 1 : 4-chlorobromo-, Trans., 910.
—— —— action of nitrous acid on, Trans., 911.
α-Naphthylamine-2 : 2′-disulphonic acid of Freund's German patent 27,346, Proc., **1895**, 82.
1 : 3-Naphthylaminesulphonic acid, i, 668.
1 : 3-Naphthylenediamine, i, 668.
α-Naphthylic carbonate, i, 152.
β-Naphthylic arsenite, i, 340.
—— methylic ether, α-chloro-, i, 511.
—— oxide, thio-, i, 237.
—— thiocarbonate, i, 131.
Naphthylindoxazen, i, 619.
2-Naphthylnaphthaquinol, Trans., 658.
Naphthyl-α-naphthaquinone, Trans., 657.
μ-Naphthylnaphthindone, i, 612.
—— amido-, i, 613.
μα-Naphthylnaphthinduline, i, 612.
3-Naphthylphenopyridazolones, i, 303.
Naphthyl-red, i, 611.
Narceïnamide, i, 630.
Narceïne, i, 630.
Narceïnimide, i, 630.
—— methiodide, i, 630.
Narceonic acid, bromo- and tribromo-, i, 630.
—— —— phenylhydrazide-anhydride and oxime-anhydride of, i, 630.
Narceonimide, i, 630.
Nascent state, the assumption of a special, ii, 43.
Natrolite, from Magnet Cove, Arkansas, ii, 510.
Natto, a Japanese vegetable cheese, ii, 130.
Nepheline, constitution of, ii, 358.
Nephrite from Kuen-Lun, ii, 510.
Neptunite, ii, 23, 402.
—— from Greenland, ii, 23.
Nerves, sensory, chemical stimulation of, ii, 79.
Neurine in blood, ii, 454.
Neutralisation, volume changes on, ii, 204.
Nickel, action of, on fused ammonium salts, Proc., **1895**, 114.
—— arsenide, ii, 21.
—— arsenites, ii, 218.
—— atomic weight of, ii, 167, 318.
—— cæsium bromide, ii, 166.
—— —— chloride, ii, 166.
—— dichromate mercury cyanide, ii, 356.
—— estimation of, in nickel-steel, ii, 421.
—— estimation, volumetric, of, ii, 534.
—— ores, chocolate, of New Caledonia, ii, 117.
—— oxidising action of ammonia solution on, Proc., **1895**, 9.
—— separation of arsenic, antimony, or tin from, ii, 89.
—— separation of bismuth from, ii, 422.
—— separation of copper from, ii, 246.
—— separation (qualitative) of cobalt from, ii, 247.
—— separation of iron from, ii, 293.
—— silicate ores, analyses of, ii, 514.
—— sodium triphosphate, ii, 446.
—— suboxide, hydrated, ii, 169.
—— sulphide, behaviour of, with alkali sulphides, ii, 355.
—— —— formation of, in solution, ii, 228.
—— —— fused, action of an electric current on, ii, 271.
—— —— properties of, at the moment of its formation, ii, 228.
—— —— solubility of, in ammonium and sodium sulphides, ii, 228.
—— thiohypophosphates, ii, 389.
—— titration of, with sodium sulphide, ii, 64.
Nickelous chloride, compound of, with pyridine, i, 122.
Nickel-steel, estimation of nickel in, ii, 421.
Nicotinamide, i, 391.
Nicotine, i, 116, 308.
—— constitution of, i, 433, 628.
—— estimation of, in tobacco, ii, 541.
—— hydrobromide, action of bromine on, i, 433, 628.
—— —— perbromide, i, 433.

Nicotine hydrobromide perbromide, dibromo-, i, 434.
—— oxidation of, i, 433.
—— quadroxalate, i, 309.
ψ-Nicotine oxide, i, 308.
Nicotinic acid, ethylbetaïne of, i, 391.
Nicotol, i, 308.
Nicotone, i, 309.
Nicotyrine, constitution of, i, 628.
Nigritella suaveolens, occurrence of vanillin in, ii, 129.
iso-Nitramineacetic acid, i, 503.
iso-Nitraminebutyric acid, i, 503.
iso-Nitraminephenylpropionic acid, i, 503.
iso-Nitraminepropionic acid, i, 503.
Nitramines, aliphatic, i, 587.
iso-Nitramines, i, 124.
iso-Nitraminevaleric acid, salts of, i, 503.
Nitrate group, specific ionic velocity of, ii, 477.
Nitrates, assimilation of, by plants, ii, 125.
—— assimilability of potassium in poor sandy soils by the action of, ii, 60.
—— basic, ii, 315.
—— estimation of, in manures, ii, 370.
—— estimation of nitric acid in, ii, 530.
—— estimation of nitrogen in, gasometrically, ii, 183.
—— loss of, in drainage, ii, 133.
Nitration of organic bases, i, 273.
Nitre, assay of, ii, 87.
Nitric acid, action of, on metals, Trans., 1151; ii, 164.
—— —— action of, on organic compounds, ii, 262.
—— —— action of thionyl chloride on, ii, 43.
—— —— estimation of, ii, 528.
—— —— estimation, volumetric, of ii, 86.
—— —— hydrate of, $HNO_3,7H_2O$, ii, 262.
—— —— molecular refraction of dissolved, Trans., 837, 845, 865.
Nitric oxide, action of, on metallic chlorides, ii, 495.
—— —— action of, on metals at high temperatures, ii, 11.
—— —— action of, on nitric peroxide, ii, 12.
—— —— action of oxygen on, ii, 12.
—— —— compound of, with ferric chloride, ii, 271.
—— —— compounds of, with ferrous and bismuth chlorides, ii, 496.
—— —— preparation of, ii, 163.
—— —— reduction of, by moist iron or zinc, ii, 445.
Nitric peroxide, action of nitric oxide on, ii, 12.
Nitric peroxide, liquid, influence of the solvent on the dissociation of, Trans., 794.
Nitrification, conditions favourable to, ii, 83.
Nitriles, a new class of, i, 257.
—— amido-, reduction of, i, 345.
—— aromatic, hydrolysis of, Trans., 601; i, 345.
—— bimolecular, and their derivatives, i, 582.
—— combination of, with aluminium chloride, i, 636.
Nitrites, indole as a test for, ii, 63.
Nitro-compounds, aromatic, reduction of, i, 214, 217.
—— —— —— reduction of, in neutral solution, i, 417.
—— —— primary and secondary, reaction for, i, 634.
Nitrogen, action of, on carbon bisulphide, ii, 495.
—— atomic refraction of, ii, 430.
—— atmospheric and chemically prepared, relative behaviour of, Proc., 1894, 222.
—— combination of, with carbon and sulphur, ii, 495.
—— compounds, refraction and dispersion of, ii, 194.
—— combustion in, ii, 272, 389.
—— density of, ii, 444.
—— estimation, gasometric, of, in nitrates, ii, 183.
—— estimation of, by Kjeldahl's method, Trans., 813; ii, 243, 528.
—— estimation of, by Kjeldahl's process, apparatus for measuring small drops of mercury for, ii, 369.
—— estimation of, in feeding stuffs by Kjeldahl's method, ii, 243.
—— estimation of, in guano, ii, 138.
—— estimation of, in manures, ii, 243.
—— estimation of, in nitrocellulose, ii, 243.
—— fixation of, influence of the root nodules of the alder on, ii, 522.
—— free atmospheric, assimilation of, by microbes, ii, 283.
—— —— fixation of, by *Algæ*, ii, 58, 59.
—— —— utilisation of, by mustard, ii, 521.
—— in the humus in soils of arid and humid regions, ii, 267.
—— Kjeldahl's method for the determination of, as applied to elementary organic analysis, Trans., 813.
—— liquid, spectrum of the electric discharge in, ii, 34.
—— loss of, in drainage water, ii, 286.
—— minimum amount of, required by human beings, ii, 232.

Nitrogen, nitric, estimation of, in presence of organic nitrogen, ii, 369.
—— of farmyard manure and green manure, utilisation of, ii, 367.
—— organic, estimation of, by Stock's method, ii, 86.
—— oxides formed during the combustion of some fuels in air, ii, 62.
—— rarefied, pressure, temperature, and volume relations of, ii, 38.
—— secondary products containing, formed during combustion in air, ii, 61.
—— so-called stereochemistry of, i, 200.
—— spectrochemistry of, ii, 194, 250.
—— total, estimation of, in urine, ii, 327.
—— —— the Gunning method of estimating in fertilisers, ii, 328.
Nitrogenous food constituents, Kuhn's method of artificial digestion of, with pepsin solution, ii, 516.
—— metabolism, ii, 359.
Nitro-groups, influence of the methyl group on the properties of, i, 654.
Nitrolic acids, i, 456.
iso-Nitroso-derivatives, affinity constants of, ii, 310.
Nitrososulphates, Trans., 456, 1095, 1098.
—— action of alcohol on, Trans., 1101.
—— constitution of, Trans., 1098.
"Nitrosulphates," Trans., 1098.
Nitrosyl chloride, action of, on amides, Trans., 489.
Nitrosylsulphuric acid, electrolysis of, in sulphuric acid solution, ii, 10.
Nitrous acid, action of hydrogen peroxide on, in dilute solution, ii, 496.
—— anhydride, existence of, ii, 12.
—— —— vapour determinations of volatilised, ii, 13.
Nitrous oxide, action of, on metals and metallic oxides, ii, 312.
—— —— estimation of, ii, 328.
—— —— reduction of, by metals in presence of water, ii, 495.
"Nitroxysulphites," Trans., 1098.
Non-electrolytes, solubility of, in mixtures of alcohol and water, ii, 156.
iso-Nonenic acid, i, 129.
iso-Nonylic acid, dibromo-, i, 128.
Norgranatanine and its salts, i, 160.
—— nitroso-, i, 160.
Norgranatenine and its salts, i, 160.
Norgranatoline and its salts, i, 160.
Nucleïc acid, precipitation of toxalbumins by, i, 692.
Nucleïn, precipitation of, by ammoniacal magnesium chloride solution, i, 692.
pseudo-Nucleïn from caseïn, digestion of, ii, 278.
Nucleoalbumin, colour reactions for ii, 376.
Nucleo-histon, ii, 52.
Nucleon, i, 314.
Nucleo-proteïds, ii, 518.
Nut-galls from mid Europe, ii, 409.
Nutrition, effect of calcium phosphate and carbonate on, ii, 173.
Nutritive substances, heat values of, ii, 51.

O.

Oat plants, composition of, ii, 365.
Oats, digestion of, by rabbits, ii, 120 517.
—— effect of mineral manures on the saline components of, ii, 130.
—— effect of various nitrogenous manures on, ii, 181.
—— effects of, on rabbits, ii, 517.
Occlusion of oxygen and hydrogen by platinum black, ii, 492.
Octacetylmaltose, Trans., 212.
αβ-*iso*-Octenic acid, i, 207.
—— —— oxidation products of, i, 208.
βγ-*iso*-Octenic acid, intramolecular change in, i, 207.
—— —— oxidation products of, i, 208.
Octocuprammonium iodide acetate, i, 330.
iso-Octoic acid, β-bromo-, i, 207.
—— —— αβ-dibromo-, i, 207.
Octomethyltetramidophenylacridine, i, 213, 222.
Octylene, magnetic rotation of, Trans., 257.
Octylic α-hydroxybutyrate, physical properties of, i, 410.
Œnanthaldoxime, action of thionyl chloride on, ii, 44.
Œnanthe crocata, poisonous constituents of, i, 680.
Œnanthotoxin, i, 680.
Oil, bay, constituents of, ii, 540.
—— —— detection of adulteration in, ii, 540.
—— castor, analysis of, ii, 147.
—— croton, detection of castor oil in, ii, 147.
—— —— vesicating constituent of, i, 680.
—— earth nut, detection of, ii, 540.
—— essential, of *Cannabis indica*, i, 623.
—— —— of hops, Trans., 54.
—— geranium, examination of rose oil for, ii, 187.
—— lemon, occurrence of citronellal in, i, 382.
—— —— specific gravity and rotatory power of, ii, 541.

Oil, linseed, analysis of, ii, 147.
—— of basswood, ii, 285.
—— of Cananga, i, 425, 551.
—— of cassia, *o*-coumaraldehyde methyl ether from, i, 279.
—— of geranium from the Isle of Reunion, i, 186.
—— of lavender, rotatory power of, i, 294.
—— of mignonette root, i, 218.
—— of pelargonium from Reunion, i, 4.
—— —— rhodinol from, i, 78.
—— of pennyroyal, i, 153.
—— of peppermint, composition and analysis of, ii, 295.
—— of spike, rotatory power of, i, 294.
—— of Ylang-ylang, i, 243.
—— olive, analytical properties of, ii, 247.
—— rose, examination of, for geranium oil, ii, 187.
—— sunflower, properties and tests for, ii, 335.
—— Turkey-red, i, 82.
Oils, Brulle's test for, ii, 248.
—— detection and estimation of metals in, ii, 463.
—— drying and non-drying, i, 447.
—— essential, detection of adulteration in, ii, 540.
—— —— detection of geraniol in, ii, 541.
—— —— so called, estimation of alcohol in, ii, 141.
—— ethereal, i, 59.
—— —— and terpenes, i, 619, 621.
—— —— assay of, ii, 91.
—— —— quantitative testing of, ii, 333.
—— Hauchecorne's test for, ii, 248.
—— Heydenreich's test for, ii, 248
—— Maumené's test for, ii, 427.
—— non-drying, effect of lead or manganese compounds on, i, 446.
—— Schneider's test for, ii, 248.
—— seed-, analytical properties of, ii, 247.
—— thermal method of examining, ii, 427.
Olefines, halogen, behaviour of, towards sodium and towards mercaptides, i, 485.
Oleïc and ricinoleïc acids, relations of, i, 647.
Olive oil, analytical properties of, ii, 247.
Opium alkaloïds, i, 117.
Optical activity of amylic derivatives in the state of liquid and vapour, ii, 472.
—— effects of different asymmetric carbon atoms in the same molecule, superposition of the, ii, 149, 195.
Optical rotation and dissociation of active compounds, ii, 301.
—— —— and electrolytic dissociation, relation between, ii, 301.
—— —— of ions, ii, 65.
Optically active halogen derivatives, i, 450, 585.
Orange peel, levulose from, ii, 129.
Orangeite, helium from, Trans., 689.
Orcinolsulphophthaleïns, i, 184.
Ores, estimation of iron in, ii, 420.
Organic compounds, estimation of halogens in, ii, 326.
—— —— estimation of sulphur in, ii, 136.
—— —— volatile, estimation of sulphur in, ii, 136.
—— matter in water, titration of, with potassium permanganate, ii, 90.
Organism, animal, absorption of fat in the, ii, 320.
—— —— action of calcium and other salts on the ii, 53.
—— —— action of copper on the, ii, 321.
—— —— behaviour of acid imides in the, ii, 280.
—— —— behaviour of the aromatic hydroxy-ketones in the, ii, 25.
—— —— effects of acid fodder on the, ii, 517.
—— —— formation of sulphuric acid in the, ii, 24.
—— —— heat value of proteïd in the, ii, 359.
—— —— paranucleïn in the, ii, 519.
—— —— the output of carbonic anhydride, and temperature in the, ii, 51, 452.
Organisms, animal, action of distilled water on, ii, 455.
Organs, animal, estimation of fat in, ii, 540.
Ortho-compounds, aromatic, action of benzimidomethyl ether on, i, 522.
Orthoclase from Canada, ii, 23.
Osazones, stereoisomeric, Trans., 606.
Osmose, variation of the course of, with the diaphragm, ii, 488.
Osmotic phenomena between ether and methylic alcohol with different diaphragms, ii, 487.
—— pressure and ionisation (electrolytic dissociation), cause of, ii, 308.
—— —— and surface tension of solutions, relation between the, ii, 41.
—— —— correct formula for, ii, 107.
—— —— nature and cause of, ii, 381.
—— —— of albuminous liquids, determination of by the cryoscopic method, ii, 7.

Ossification, chemical phenomena of, ii, 518.
Ox, calcium in the liver cells of the, ii, 53.
Oxalic acid, action of thionyl chloride on, ii, 43.
—— —— amido-derivatives of, i, 449.
—— —— localisation of, in plants, ii, 129.
—— —— occurrence of, in beetroot, ii, 177.
Oxaluric acid, metallic derivatives of, i, 269.
Oxalylbisnitrophenylhydrazine, i, 27.
Oxalyldiacetophenone, products of the reduction of, i, 464.
Oxalyldibenzyl ketone, i, 373.
—— —— action of hydroxylamine on, i, 374.
—— —— anilide, i, 374.
—— —— compound of, with phenylhydrazine, i, 374.
—— —— isomeride of, i, 374, 375.
—— —— oxidation of, i, 375.
—— —— phenylhydrazone, i, 374.
iso-Oxalyldibenzyl ketone and its derivatives, i, 375.
—— oxidation of, i, 375.
Oxalyldihydroxamic tetracetate, i, 393.
Oxalyldipicrylhydrazine, i, 28.
Oxalylhydrazide, i, 264.
Oxamic acid, action of nitrosyl chloride on, Trans., 490.
Oxamide, action of nitrosyl chloride on, Trans., 490.
—— m. p. of, ii, 379.
Oxanilide, action of nitrosyl chloride on, Trans., 490.
Oxazines of the naphthalene series, i, 245.
Oxazolonehydroxamic acid, salts of, i, 393.
iso-Oxazolonimide, i, 585.
Oxazomalonic acid, i, 503.
Oxidation by incomplete combustion, i, 271.
Oxidising action of animal tissue, ii, 234.
Oximes, affinity constants of, ii, 311.
—— isomerism of the, i, 200.
—— formation of, as a reversible reaction, ii, 259.
Oxindenecarboxylic acid, dichlor-, i, 231.
—— —— —— lactone from, i, 231.
Oxonic acid, i, 129.
Oxy-compounds, effect of, on the freezing point of benzene, ii, 41.
Oxybehenic acid, constitution of, i, 16.
Oxygen and hydrogen, ratio of the atomic weights of, ii, 9.
—— atomic refraction of, ii, 430.
—— atomic weight of, ii, 261.
Oxygen, effect of, on alcoholic fermentation, ii, 282.
—— in presence of sunlight, oxidising properties of, ii, 493.
—— influence of, on the coagulation of blood, ii, 78.
—— liquid, spectrum of the electric discharge in, ii, 33.
—— occlusion of, by platinum black, ii, 492.
—— possible explanation of the twofold spectra of, ii, 469.
—— rarefied, pressure, volume, and temperature relations of, ii, 38.
—— refraction and dispersion of, ii, 471.
Oxy-hydrogen gas, condensation of, by metals of the platinum group, ii, 150.
Oxynicotine, i, 308.
Oxyphosphazo-*p*-chlorobenzenechloranilide, i, 364.
Oxypyridine derivatives, Trans., 399.
Oxysulphantimonic acid, Trans., 542.
Oxysulpharsenic acid, Trans., 533.
Oyster shells, ii, 279.
Oysters, phosphorus in, ii, 456.
Ozobenzene, i, 593.
Ozone, atmospheric, influence of, on vegetation, ii, 240.
—— bye-products formed in the action of, on ammonia, ii, 74.
—— formation of, by the action of electric oscillations, ii, 109.
—— oxidising action of, ii, 493.
—— solubility of, in water, ii, 216.

P.

Pachyma cocos, carbohydrate from, i, 323.
Pachymose, i, 323.
Palladium, absorption of hydrogen by, ii, 388.
—— action of, on fused ammonium salts, Proc., **1895**, 114.
—— condensation of electrolytic gas by, ii, 151.
—— selenide, crystallisation of, ii, 391.
—— septum, passage of hydrogen through, ii, 39.
Palladium-antimony alloy, ii, 392.
Palladium-bismuth alloy, ii, 392.
Palmitamide, heat of formation of, ii, 483.
Palmitic anilide, heat of formation of, ii, 483.
Palmitolic acid, constitution of, i, 126.
Pancreas, glycolytic ferment from, ii, 277.
Pancreatic digestion, leucine from, i, 83.

Pancreatic digestion of albumin, ii, 233.
—— duct, absorption and metabolism in obstruction of the, ii, 454.
—— fermentation, the leucine of the, ii, 25.
—— juice, action of, on starch, ii, 403.
Parabanic acid, behaviour of, in the animal organism, ii, 280.
Paracotoïn, i, 111.
Para-*iso*-dextrin, i, 323.
Paraffin, estimation of, in crude anthracene, ii, 423.
Paraffins, nitro-, constitution of the salts of, i, 3.
—— preparation of, i, 77.
—— preparation of, in a state of purity, i, 2.
Paralactic acid, in normal pericardial fluid, ii, 405.
Paraldehyde, formation of, i, 197.
Paramucin, ii, 361.
Paranucleïn in the animal organism, ii, 519.
Paranucleons, i, 314.
Parapectin, i, 8.
Parapropaldehyde, i, 200.
Parapyruvic acid, i, 449.
Paratungstic acid, ii, 503.
Parisite from Greenland, ii, 401.
Parmelia parietina, physicon from, i, 299.
—— *perlata*, vulpic and usnic acids in, i, 299.
Parmelin, i, 299.
Parvoline from coal tar, i, 390.
Peat, estimation of dry matter in, ii, 544.
Pectase, i, 312.
Pectic acid, i, 8.
Pectic fermentation, i, 312.
Pectin from beet, i, 556.
Pectose, i, 8.
Pectous substances, properties and reactions of, i, 8.
Pelargonic acid, affinity constant of, ii, 253.
Pelargonium, oil of, from Reunion, i, 4.
Pelargonium-rhodinol, i, 4.
ψ-Pelletierine, i, 254.
Pellitorine, Trans., 101.
Pellitory of medicine, the active constituent of, Trans., 100.
Pellotine, i, 120.
Pennyroyal oil, i, 153.
Pentacetyltannin, i, 420.
Pentadecoic acid, i, 119.
Pentane, incomplete combustion of, Proc., **1894**, 181.
Pentaquinoline cobaltous chloride, i, 122.
Pentenic acid, dibromo-, i, 510.
Pentenic acids from the interaction of propaldehyde and malonic acid, i, 204.
$\beta\gamma$-Pentenic acid, intramolecular change in, i, 204.
$\gamma\delta$-Pentenic acid, experiments with, i, 204.
Pentosans, digestibility of, ii, 278, 404.
—— estimation of, ii, 144.
—— estimation of furfuraldehyde in, ii, 426.
—— formation of, in plants, i, 7.
—— in plants, ii, 176.
Pentoses, estimation of furfuraldehyde in, ii, 426.
—— in diabetic urine, ii, 406.
Peppermint oil, American, composition and analysis of, ii, 295.
Peptic digestion, ii, 232.
Peptone, colour reactions for, ii, 376.
—— disappearance of leucocytes from the blood after the injection of, ii, 79.
—— in urine, ii, 25.
Peptones, commercial, estimation of the nitrogenous constituents of, ii, 543.
—— estimation of, ii, 468, 543.
Pepsin, influence of acids and other substances on the activity of, ii, 516.
Perchloric acid, preparation of, ii, 444.
—— —— use of, in estimating potassium, ii, 444.
Percolator, simple, ii, 345.
Percylite, ii, 115.
Pereiro bark, i, 312.
Pericardial fluid, paralactic acid in the, ii, 405.
Periodic law and refraction equivalent of the elements, Proc., **1895**, 10.
—— system, history of the, ii, 439.
—— —— modified, ii, 491.
Permanganic acid, electrical conductivity of, ii, 451.
Persian berries, a constituent of, Trans., 496.
Petroleum, estimation of sulphur in, ii, 412.
Petroleums, analysis of, ii, 90.
Pharmacolite, ii, 508.
Phenacite from Ober-Neusattel, ii, 172.
Phenanthraquinone, action of benzylamine on, Trans., 46.
—— action of methylamine on, Trans., 45.
—— condensation of, with carbamide, i, 425.
—— dithioureïde from, i, 425.
Phenazine-like substance from the oxidation of *o*-amidophenol, i, 25.

Phenetoïl, *p*-chloro-, i, 511.
—— dibromoseleno-, i, 341.
—— dichloroseleno-, i, 341.
—— diiodoseleno-, i, 341.
—— selenium derivatives of, i, 341.
—— seleno-, i, 341.
p-Phenetoïlcarbamide, i, 359.
Pheno-*m*-diazine derivatives, i, 250, 306, 398.
Phenol, action of diazomethane on, i, 494.
—— action of ethylic chloracetate and dichloracetate on the sodium derivatives of, i, 44.
—— alteration of, by the action of light, and the formation of hydrogen peroxide, i, 340.
—— *o*-amido-, action of chlorine on, i, 131.
—— —— condensation of, with *p*-toluenesulphonic chloride, i, 369.
—— —— red oxidation product of, i, 25, 220.
—— *p*-amido-, action of, on *o*-diketones, i, 214.
—— dichloride, hexachloro-, i, 273.
—— α-dinitro- and acetanilide, melting points of mixtures of, Trans., 331.
—— —— and *o*-nitrophenol, melting points of mixtures of, Trans., 332.
—— α-hexachloro-, i, 272.
—— —— action of acid chlorides on, i, 593.
—— —— action of aluminium chloride on, i, 594.
—— —— constitution of, i, 655.
—— —— formation of tetrachloroquinone from, i, 343.
—— *o*-nitro- and α-dinitrophenol, melting points of mixtures of, Trans., 332.
—— oxidation of, by incomplete combustion, i, 272.
—— 1 : 2 : 3-triamido, conversion of, into 1 : 2 : 3 : 5-tetrahydroxybenzene, i, 458.
o-Phenolbenzylamine, i, 372, 537.
Phenolnaphthaleïn, i, 425.
—— oxime, i, 425.
Phenolphthaleïn, action of bromine on, i, 56.
—— action of iodine on, i, 539.
—— constitution of the alkali compounds of, i, 99.
—— derivatives, i, 376.
—— tetraiodo-, i, 539.
iso-Phenolphthaleïn, i, 219.
Phenolphthaleïnanhydride, i, 54.
Phenolphthaleïnanhydrideanilide, i, 54.
Phenols, action of phthalic chloride on, i, 219.
—— *o*-amido-, oxidation of, i, 25.
—— and their ethers, action of sulphuryl chloride on, i, 342.
—— condensation of, with mandelic acid, i, 419.
Phenonaphthacridine, i, 107.
Phenopyridazolone (phthalazone), i, 302.
Pheno-3-pyridazolonecarboxylic acid, i, 303.
Phenoquinone, constitution of, i, 513.
Phenosafranine, electrolytic conductivity of, i, 540.
Phenoxyacetal, i, 360.
Phenoxyacetaldehyde, i, 360.
—— phenylhydrazone, i, 361.
Phenoxyacetic acid, *o*-bromo-, i, 44.
—— —— thermochemistry of, ii, 102.
Phenoxyacetonitrile, i, 361.
Phenoxyacetoxime, i, 361.
γ-Phenoxydipropylmalonic acid, i, 480.
Phenoxyformophenylamido-dichloride, i, 277.
Phenoxymethylenecamphor, i, 64.
ε-Phenoxy-β-propylamylamine, i, 480.
δ-Phenoxy-α-propylvaleric acid, i, 480.
δ-Phenoxy-α-propylvaleronitrile, i, 480.
Phentetrol, i, 457.
Phenyl benzyl ketone, reduction of, by sodium ethoxide, i, 601.
—— naphthyl ketone, *o*-bromo-, i, 477.
—— —— ketoxime, *o*-bromo-, i, 477, 619.
—— quinone sulphone, i, 144.
Phenylacetic acid, antiseptic action of, ii, 58.
—— —— iodo-, new class of cyclic iodine compounds from, i, 139.
—— —— —— preparation and properties of, i, 139.
—— —— iododichloride of, i, 139.
Phenylacetophenone, *p*-nitro-, i, 290.
o-Phenylamidocinnamic acid, i, 532.
p-Phenylamidocinnamic acid, i, 532.
2-Phenylamido-4 : 5-diphenyldihydro-1 : 3-azoxole, i, 597.
Phenyl-α-amidolactic acid, i, 281.
—— —— lactimide of, i, 281.
Phenylamidomaleïnimide, i, 103.
Phenyl-μ-amidophenylinduline, i, 608.
Phenylamidophenylmauveïne, i, 609.
2′-Phenylamidoquinoline methiodide, i, 156.
—— methochloride, i, 156.
Phenylamido-*m*-xylidine, symmetrical trinitro-, i, 654.
Phenylauramine, *o*-amido-, i, 185.
—— *p*-amido-, i, 184.
Phenylauraminephenylthiocarbimide, *o*-amido-, i, 185.
—— *p*-amido-, i, 185.

Phenylazocarbamide, Trans., 1067 ; i, 603.
—— tribromo-, i, 604.
Phenylazocarboxylic acid, i, 603.
—— —— tribromo-, i, 603.
Phenylazo-*o*-cresol, i, 352.
Phenylazodiethylaniline, *p*-nitro-, i, 352.
Phenylazodiethyl-*o*-toluidine, *p*-nitro-, i, 618.
Phenylazodimethyl-*o*-toluidine, *p*-nitro-, i, 352.
Phenylazoethylaniline, *p*-nitro-, i, 352.
Phenylazoimide, 2 : 4-dinitro, i, 29.
—— *p*-nitro-, action of hydrazine hydrate on, i, 30.
Phenylazomethylaniline, *p*-nitro-, i, 352.
Phenylazo-α-naphthol, *p*-bromo-, i, 619.
—— *p*-nitro, i, 352.
Phenyl-2-azo-1-naphthol, *o*-nitro-, i, 618.
Phenyl-4-azo-1-naphthol, *o*-nitro-, i, 618.
Phenylazo-β-naphthol, *p*-nitro-, i, 352.
Phenylazophenol, *p*-nitro-, i, 352.
Phenylbenzaldehyde, *p*-nitro-, i, 290.
Phenylbenzoic acid, *p*-nitro-, i, 290.
Phenyl-ψ-benzylcyanothiocarbamide, i, 461.
β-Phenylbenzyl-αγ-diketohydrindene, i, 536.
Phenylbenzylic alcohol, *p*-nitro-, i, 290.
Phenylbenzylketazine, i, 608.
Phenylbenzylmalonic acid, i, 368.
Phenylbenzylmethylenehydrazine, i, 607.
3′ : 1′-Phenylbenzyltetrahydroquinazoline, 2′-thio-, i, 134.
d-Phenylbromacetic acid, i, 451.
—— chloride, i, 451.
Phenylbutyric acid, antiseptic action of, ii, 58.
—— —— β-bromo-, i, 223.
—— —— hydroxy-derivatives of, i, 92.
Phenylcamphoric anhydride, i, 108.
Phenylcarbamide, preparation of the sodium derivative of, i, 289.
d-Phenylchloracetic acid, i, 451.
—— chloride, i, 451.
Phenyl-α-chlorolactic acid, 3 : 6-bromonitro-, i, 282.
o-Phenylcinchonic acid, carboxy- and hydroxy-derivatives of, i, 71.
β-Phenylcoumalic acid, i, 111.
Phenylcoumalin, i, 554.
—— fusion of, with potash, i, 554.
Phenylcoumalin-catechol, i, 554.
Phenylcoumalin-cotoïn, i, 554.
Phenylcoumalin-quinol, i, 554.
Phenylcoumalin-resorcinol, i, 554.
Phenyl-*o*-cresolamine, i, 372, 537.
αβ-Phenylcrotonic acid, i, 223.
βγ-Phenylcrotonic acid, intramolecular change in, i, 223.
Phenyl-1-*iso*-crotonic acid, 1 : 2-dichloro-, dichloro-α-naphthols, and trichloronaphthalenes from, Proc., 1895, 78.
Phenylcyanopyruvic acid, Erlenmeyer's, nature of, i, 103.
Phenylcysteïn, benzoyl, ethyl and phenyl derivatives of, i, 284.
—— iodo-, i, 606.
Phenyldiamidophenylic bisulphide, i, 133.
Phenyldibenzoylacetic acid, Proc., 1895, 147.
Phenyldibenzoylmethane, Proc., 1895, 147.
Phenyldiketopentoic acid, i, 395.
Phenyldiketotetrahydroquinazoline, i, 307.
Phenyldioxythiazoleacetic acid, i, 13.
μ-Phenyldiphenyleneoxazole, Trans., 46.
Phenyldipiperidylguanidine, i, 416.
Phenyl-αβ-dithiophenylpropylsulphone, i, 230.
Phenyldithiourazole, i, 402.
cyclo-Phenylenebenzylidene oxide, i, 537.
m-Phenylenediamine, condensation of glyoxylic acid with, i, 171.
Phenylenediamines, action of chloroform and potash on, i, 568.
o-Phenylenediauramine, i, 185.
p-Phenylenediauramine, i, 185.
Phenylethylenediamine, i, 274, 345.
α-Phenylethylic bisulphide, i, 362, 363.
—— mercaptan, i, 363.
Phenylfluorindine, chloro-, i, 526.
Phenylglycidic acid, 3 : 6-bromonitro-, i, 282.
—— —— chloronitro-, i, 282.
—— acids, nitro-, i, 281.
Phenylglycoline, i, 155.
—— ethyl ether, i, 155.
—— —— —— nitrosamine of, i, 155.
Phenylhydrazicarbamine, i, 31.
Phenylhydrazidoacetanilide, i, 521.
—— action of sodium ethoxide on, i, 521.
—— condensation of, with aldehydes and ketones, i, 521.
Phenylhydrazidoacetic acid, asymmetrical, i, 460.
—— —— symmetrical, i, 461.
β-Phenylhydrazidobenzylmalonic acid, potassium salt of, i, 471.
2′-Phenylhydrazidoquinoline methiodide, i, 156.
—— methochloride, i, 156.
Phenylhydrazine, action of nitrosobenzene on, Trans., 928.
—— as a reducing agent, i, 595.
—— derivatives, action of magnesium on, Proc., 1895, 9.
—— 2 : 4-dinitro-, and its derivatives, i, 27, 29.

Phenylhydrazine, *o*-nitro-, action of alkalis on, i, 135.
—— 2 : 4 : 6-trinitro-, derivatives of, i, 27–30.
Phenylhydrazobenzile, 2 : 4-dinitro-, i, 28.
Phenylhydrazobenzophenone, 2 : 4-dinitro, i, 28.
Phenylhydrazomethane, 2 : 4-dinitro- i, 27.
Phenylhydrazoneacetic acid, *m*-bromo-, i, 660.
Phenylhydrazopropane, 2 : 4-dinitro-, i, 28.
Phenylhydrocarbostyril, i, 532.
Phenylhydro-*p*-coumaric acid, i, 533.
"Phenylhydroxycrotonic acid," identity of, with benzoylpropionic acid, i, 533.
Phenylhydroxydiphenylethylthiocarbamide, i, 597.
Phenylhydroxylamine, *p*-bromo-, i, 459.
Phenylhydroxy-*p*-tolylacetic acid, i, 419.
—— lactone, i, 419.
Phenylic acetate, pentachloro-, i, 593.
—— acetoxyhippurate, i, 284.
—— anhydrohippurate, i, 284.
—— —— dichloro-, i, 284.
—— arsenite, i, 340.
—— benzenesulphonate, *p*-chloro-, i, 512.
—— benzoate, action of bromine on, i, 280.
—— —— bromo-, i, 281.
—— —— pentachloro-, i, 594.
—— α-benzoylamido-α-chloropropionate, i, 284.
—— bisulphide, *p*-diamido-, i, 87.
—— *p*-bromophenylic phenylimidocarbonate, i, 416.
—— bromophenylmercapturate, i, 284.
—— bromosalicylate, i, 280.
—— α-bromothiophenyl-α-benzoylamidopropionate, i, 284.
—— butyrate, pentachloro-, i, 593.
—— campholate, i, 295.
—— carbonate, *p*-bromo-, i, 416.
—— —— pentachloro-, i, 594.
—— *p*-chloraniline-*n*-phosphinate, i, 364.
—— dibromosalicylate, i, 280.
—— dihydrogen phosphate, pentachloro-, i, 652.
—— diphenylamine-*n*-phosphinate, i, 364.
—— diselenoxide, i, 413.
—— hydroselenide, i, 413.
—— hydrosulphide, *p*-iodo-, i, 606.
—— imidochloroformate, i, 416.
—— —— *p*-bromo-, i, 416.
—— phenylamidocarbonate, *p*-bromo-, i, 416.
—— —— *p*-chloro-, i, 416.
Phenylic phenylimidocarbonate, i, 415.
—— —— *p*-bromo-, i, 416.
—— propionate, pentachloro-, i, 593.
—— salicylate, action of bromine on, i, 280.
—— selenoxide, chloro-, i, 413.
—— sulphide, *p*-diamido-, i, 87.
—— —— *p*-dinitro-, i, 132.
—— *o*-sulphobenzoate, i, 475.
—— thiocarbonate, i, 131.
—— tribromosalicylate, i, 280.
—— —— bromo-, i, 280.
Phenylimidazolone, nitro-, i, 218.
Phenylimidoacetic acid, i, 687.
Phenylimidocarbonates, i, 415.
Phenylimidocarbonyl bromide, i, 277.
2-Phenylimido-5-imido-3 : 4-dithiazolidine, i, 576.
Phenylindoxazen, dibromo-, i, 371.
Phenylindoxazendisulphonic acid, i, 371.
2-Phenylindoxyl, i, 371.
μ-Phenylinduline, i, 608.
Phenylisuretine, i, 11.
Phenyl-β-lactaldehyde, 3 : 6-bromo-, nitro-, i, 282.
—— —— phenylhydrazone of, i, 282.
Phenyl-β-lactic acid, 3 : 6-bromonitro-, i, 282.
Phenylmauveïne, i, 609.
Phenylmercaptansulphonic acid, potassium salt of, PROC., **1895**, 141.
Phenylmercapturic acid, *p*-iodo-, i, 605.
—— acids, bromo-, derivatives of, i, 284.
Phenylmethane, nitro-, i, 455.
—— sulphone of, i, 284.
Phenylnaphthalimide, i, 239.
n-Phenylnaphthimidazole-β-benzene-*o*-carboxylic acid, i, 57.
n-Phenylnaphthimidazole-β-propionic acid, i, 57.
β-Phenylnaphthylamine, action of nitrosodimethylaniline on, i, 611.
—— azo-derivatives of, i, 238.
β-Phenylnaphthylenecarbamide, i, 57.
Phenylnaphthylketonesulphonic acid, *o*-bromo-, i, 477.
Phenylnaphthylsulphone, i, 471.
Phenylnitramine, i, 273.
—— *p*-bromo-, i, 274.
—— *p*-chloro-, i, 274.
—— *m*-, *o*-, and *p*-nitro-, i, 273.
Phenylnitrocinnamic acids and their derivatives, crystallography of, i, 533.
—— —— and their isomerides, i, 531.
Phenyl-*m*-nitrocinnamic acids, isomeric, i, 532.
Phenyl-*o*-nitrocinnamic acids, isomeric, i, 531.
Phenyl-*p*-nitrocinnamic acids, isomeric, i, 532.

Phenylnitromethane, preparation of, i, 23.
Phenylnitrosamine, *p*-nitro-, action of acid chlorides on the sodium derivative of, i, 182.
Phenylnitrosohydrazine, 2 : 4-dinitro-, i, 29.
Phenyloxamide, action of nitrosyl chloride on, Trans., 490.
Phenyl-αβ-pentenic acid, brominated acids from, i, 224.
—— —— oxidation of, i, 225,
Phenyl-βγ-pentenic acid, brominated acids from, i, 224.
—— —— intramolecular change in, i, 223.
—— —— oxidation of, i, 225.
Phenyl-γδ-pentenic acid, dibromo-, i, 224.
Phenylpentenolactone, i, 224.
β-Phenylpheno-*m*-diazine derivatives, i, 251.
μ-Phenylphenopenthiazole, i, 191.
3-Phenylphenopyridazolone, i, 303.
Phenylphenylene-blue, dinitro-, i, 278.
1-Phenyl-2-phenylimido-5-thio-3 : 4-dithiazolidine, i, 579.
Phenyl-μ-phenylinduline, i, 608.
Phenylpiperine, i, 469.
Phenylpropionic acid, antiseptic action of, ii, 58.
—— —— 2 : 4 : 6- tribromo-, i, 467.
—— —— 2 : 4 : 6 : 3-tribromamido-, i, 467.
Phenylpyrazole, 4-bromo-, i, 396.
—— m. p. 78°, constitution of, i, 395.
—— —— nitro-, i, 396.
—— m. p. 228°, constitution of, i, 303, 395.
3-Phenylpyrazole, i, 192, 687.
4-Phenylpyrazole, formation of, i, 396.
5-Phenylpyrazole, i, 192.
4 : 3-Phenylpyrazolecarboxylic acid, i, 396.
Phenylpyrazoledimethylcarbinol, i, 396.
Phenylpyrazoles, constitution of, i, 395, 396, 371.
1 : 5-Phenylpyrazolidine, i, 394.
1-Phenylpyrazoline, isonitroso-, i, 249.
Phenylpyrazolone, m. p. 155°, constitution of, i, 303.
n-Phenylpyrazolone, constitution of, i, 570, 686.
1 : Phenyl-5-pyrazolone, i, 193.
—— constitution of, i, 570.
—— *iso*-nitroso-, i, 193.
3-Phenylpyrazolone, i, 247, 686.
—— 4-amido-, i, 686.
—— dibromo-, i, 687.
—— *iso*-nitroso- and its acetyl, benzoyl, and ethyl derivatives, i, 686.
3-Phenylpyrazolone, 4-*iso*-nitroso-, i, 247.
3-Phenylpyrazolone-4-azobenzene, i, 687.
3-Phenylpyrazolone-blue, i, 687.
Phenylpyrazolonediketohydroxypyridine, phenylhydrazone of, i, 157.
Phenylpyrazolonephenylpyridazonecarboxylic acid, i, 157.
3-Phenylpyrazolonerubazonic acid, i, 686.
3-Phenylpyridazinone, i, 248.
3-Phenylpyridazinone-5-carboxylic acid, i, 248.
—— —— hydrazide of, i, 248.
3-Phenylpyridazolone and its nitroso-derivative, i, 302.
Phenylpyridine, *p*-nitro-, i, 290.
6 : 2-Phenylpyridinecarboxylic acid, i, 563.
1-Phenylpyrroline, i, 627.
—— tetrachloro-, i, 176.
2-Phenylpyrroline, i, 627.
4′-Phenylquinaldine, derivatives of, i, 430.
γ-Phenylquinaldinic acid, new synthesis of, i, 431,
2′-Phenylquinoline, i, 481.
4′-Phenylquinoline, derivatives of, i, 430.
2′-Phenylquinoline-1 : 4′-dicarboxylic acid, i, 71.
3′-Phenylquinolinesulphonic acids, i, 431.
Phenylrosinduline, nitro-, i, 610.
—— trinitro-, i, 610.
o-Phenylsalicylic acid, i, 233.
Phenylsemicarbazide, action of benzaldehyde on, Trans., 1064; Proc., **1895**, 124.
—— action of nitrous acid on, i, 603.
—— tribromo-, symmetrical, i, 604.
Phenylserine, i, 281.
Phenylsulphonamide, action of carbonyl chloride on, i, 288.
Phenylsulphone-α-propylenic glycol, i, 229.
—— benzoate, i, 229.
Phenylsulphonepropylic alcohol, i, 286.
—— benzoate, i, 286.
4′-Phenyltetrahydroquinaldine, i, 431.
4′-Phenyltetrahydroquinoline, i, 431.
—— 3-nitroso-, i, 431.
4-Phenyltetrazole bisulphide, i, 194.
4-Phenyltetrazole-3-methylthiole, i, 193.
4-Phenyltetrazole-3-sulphonic acid, i, 193.
4-Phenyltetrazole-3-thiole, i, 193.
Phenylthiocarbimide, action of bromine on, i, 578.

4-Phenylthiosemicarbazide hydrochloride, i, 193.
4-Phenyl-3-thiotetrazoline, i, 193.
o-Phenyltoluene, *p*-amido-, i, 289.
—— *p*-nitro-, i, 289.
—— synthesis of, i, 606.
—— tribromo-, i, 606.
p-Phenyltoluene, synthesis of, i, 606.
β-Phenyl-*p*-toluo-*m*-diazine, i, 400.
β-Phenyl-*p*-toluo-*m*-diazine-α-carboxylic acid, i, 400.
Phenyl-1 : 2 : 4-trihydroxybutane, i, 489.
—— triacetate, i, 489.
Phenyl-*p*-tolylbenzenylamidine, i, 347.
ab-Phenyl-*m*-tolylcarbamide, Trans., 562.
ab-Phenyl-*p*-tolylcarbamide, Trans., 562.
Phenyl-*p*-tolylethenylamidine, i, 347.
Phenyltolylmethane, preparation of, Trans., 828.
ab-Phenyl-*m*-tolylthiocarbamide, Trans., 557.
Phenyl-*p*-tolyltriazole, i, 137.
ab-Phenyl-*m*-tolylurea, Trans., 562.
ab-Phenyl-*p*-tolylurea, Trans., 562.
Phenylvaleric acid, β-bromo-, i, 224.
—— —— αβ-dibromo-, i, 223.
—— —— βγ-dibromo-, i, 224.
Phenylvalerolactone, dibromo-, i, 224.
Phenylxylylmethane, preparation of, Trans., 828.
ab-Phenyl-*m*-xylylthiocarbamide, Trans., 558.
Phlobaphene, i, 470.
Phloretin, constitution of, i, 45, 538.
Phloroglucinol, action of alkalis on brominated derivatives of, i, 343.
—— action of, on sugars, i, 164.
Phorone, action of ethylenediamine on, i, 328.
Phosphate, from Grand-Connétable, ii, 242.
—— soluble, estimation of, ii, 184.
Phosphates, estimation of aluminium in, ii, 533.
—— estimation of iron and aluminium in, ii,140, 246, 293.
—— estimation of the manurial value of, ii, 461.
—— insoluble in water, estimation of the value of, ii, 139.
—— manuring experiments with various, ii, 180.
—— mineral, estimation of citrate-soluble phosphoric acid in, ii, 243.
—— natural, agricultural value of various, ii, 28.
—— —— solvent action of carbonic acid on, ii, 29.
Phosphates, natural, solvent action of citric acid on, ii, 29.
Phosphazobenzene thioanilide, i, 463.
—— thiochloride, i, 463.
—— —— *p*-chloro-, i, 462.
Phosphazo-*o*-toluene thioanilide, i, 463.
—— thiochloride, i, 463.
—— —— i, 463.
—— thio-*o*-toluidide, i, 463.
Phosphazo-*p*-toluene thiochloride, i, 463.
—— thiopiperidide, i, 463.
—— thio-*p*-toluidide, i, 463.
Phosphazotrimethylbenzene thiochloride, i, 463.
Phosphine, removal of, from acetylene prepared from calcium carbide, i, 635.
Phosphoduodecimolybdic acid, ii, 112.
Phospholuteomolybdic acid, ii, 112, 113.
Phosphomolybdic acid and its salts, action of hydrofluoric acid on, ii, 18.
Phosphocarnic acid, i, 313.
Phosphorescence at the temperature of boiling liquid air, Proc., **1894**, 171.
Phosphoric acid and metaphosphoric acid, action of thionyl chloride on, ii, 43.
—— —— citrate-soluble, estimation of, in basic slag and in mineral phosphates, ii, 243.
—— —— compounds soluble in water, of, in superphosphate ii, 131.
—— —— estimation of, ii, 291, 530.
—— —— estimation of, by the citric acid process, ii, 138.
—— —— estimation of, by the molybdate-magnesia method, ii, 329, 414.
—— —— estimation of, by the molybdate method, ii, 414, 415.
—— —— estimation of, by titration of the molybdate precipitate, ii, 183.
—— —— estimation of, in manures, ii, 243.
—— —— (officinal) estimation, volumetric, of, ii, 329.
—— —— estimation, volumetric, of, ii, 184.
—— —— estimation, volumetric, of, by titrating the yellow precipitate, ii, 85.
—— —— estimation, volumetric, of, in superphosphates, ii, 244, 290.
—— —— foraging powers of some agricultural plants for, ii, 124.
—— —— peculiar property of, in peaty soil, ii, 285.
—— —— soluble in water, behaviour of, towards the absorbent constituents of soil, ii, 524.
—— amorphous, action of hydrogen on, ii, 348.

Phosphorus, chloronitride, ii, 217.
—— estimation of, in coal and coke, ii, 328.
—— estimation of, in iron, ii, 328, 414, 530.
—— estimation of, in steel, ii, 30, 414, 530.
—— estimation, volumetric, of, in cast iron, ii, 414.
—— estimation, volumetric, of, in steel, ii, 30, 414.
—— in oysters, ii, 456.
—— in the digestion products of caseïn, ii, 54.
—— of caseïn, behaviour of, in peptic digestion, ii, 119.
—— percentage of, in the hepatic and splenic cells at different ages, ii, 54.
—— products of the slow oxidation of, ii, 262.
—— rate of oxidation of, ii, 213.
—— refractive indices of, in carbon bisulphide solution, ii, 97.
—— test, Eggertz's, ii, 530.
Photographic action at the temperature of boiling liquid air, Proc., **1894**, 171.
—— dry plates, action of hydrogen on, ii, 265.
—— image, latent development of, by alkali peroxides, ii, 66.
Photographs, cause of the fugitiveness of, when fixed with sodium thiosulphate, ii, 349.
Phthalanil, *m*-nitro-, i, 135, 360, 414.
—— *o*-nitro-, i, 414.
—— *p*-nitro-, i, 134, 360, 414.
Phthalanilide, *m*-, *o*-, and *p*-, nitro-, i, 414.
Phthalazine, ethiodide, i, 569.
—— preparation of, i, 568.
Phthalazone, i, 302.
Phthaleïn melts, i, 538.
Phthaleïns of *o*-sulpho-*p*-toluic acid, i, 183.
—— quinoïdal, i, 55.
—— tauto-, i, 55.
Phthalic acid, ethereal salts of, i, 538.
—— —— mixed anhydrides of, i, 539.
—— —— tetrachloro-, etherification of, i, 93.
—— acids, nitro-, etherification of, i, 93.
—— anhydride, action of hydroxylamine on, i, 417.
—— chloride, action of, on nitranilines, i, 360.
—— —— action of, on phenols, i, 219.
—— —— heat of formation of, ii, 483.
iso-Phthalic acid, action of phenylic isocyanate on, i, 680.
—— —— *m*-iodo-, i, 226.
iso-Phthalic acid, *o*-iodo-, i, 226.
—— —— *o*-iodoso-, i, 226.
Phthalide, heat of formation of, ii, 484.
Phthalimide, action of nitrosyl chloride on, Trans., 491.
—— behaviour of, in the animal organism, ii, 280.
—— electrolysis of, i, 209.
Phthalophenoneanilide, i, 55.
Phthalyl-*o*-amidodiphenylmethane, i, 53.
iso-Phthalylbenzhydroxamic acid, i, 39.
Phthalyldiamidoacetal, i, 90.
Phthalyldiamidoacetaldehyde, i, 90.
iso-Phthalyldiamidoacetaldehyde, i, 91.
iso-Phthalyldiamidoacetic acid, i, 91.
iso-Pthalyldiamidoacetyl, i, 91.
Phthalyldithiocarbimide, Trans., 573.
—— action of various bases on, Trans., 574.
—— derivatives of, Trans., 565.
Phthalylhydrazide, i, 354.
Phthalylhydrazideacetic acid, i, 355.
iso-Phthalylhydroxamic acid, i, 37.
tere-Phthalyl-. See Terephthalyl-.
Phycoerythrin, i, 556.
Phyllites, ii, 23.
Phyllocyanin copper acetate, i, 624.
Phylloporphyrin, i, 297.
Physcia medians, ethylic vulpate and calycin from, i, 298.
—— *parietina*, physcion in, i, 299.
Physcianin, i, 300.
Physcihydrone, i, 300.
Physciol, i, 300.
Physcion and its derivatives, i, 299.
—— nitro- and dinitro-, i, 300.
Physconic acid, i, 300.
Physico-chemical measurements, methods of, ii, 491.
Physiological action of acetonitrile and its homologues, ii, 238.
—— —— of barium salts, ii, 321.
—— —— of carbonic oxide, ii, 407.
—— —— of certain pyridine, naphthalene and quinoline derivatives, ii, 56.
—— —— of chlorocaffeïne and of cyanocaffeïne, ii, 238.
—— —— of cinchotoxine, i, 435.
—— —— of extract of pituitary body, ii, 405.
—— —— of extract of suprarenal capsules, ii, 235, 405.
—— —— of hydrohydrastinium hydrochloride, ii, 362.
—— —— of hydroxylamine, ii, 413.
—— —— of piperovatine, Trans., 99.
—— —— of potassium silicate, ii, 237.
—— —— of sodium copper tartrate, ii, 321.

Physiological action of synthesised colloïds, ii, 454.
—— —— of tolylenediamine, ii, 456.
—— —— of very low temperatures, ii, 254.
Picene, i, 292.
Picenecarboxylic acid, i, 293.
Picenefluorene, i, 293.
—— alcohol, i, 293.
Picenequinone, i, 292.
Picenequinonecarboxylic acid, i, 293.
Picenic acid, i, 293.
Picoline chloride, compounds of, with lead dichloride and tetrachloride, i, 390.
Picolineacrylic acid, i, 564.
Picoline-α-bromopropionic acid, i, 564.
Picoline-α-lactic acid, i, 563.
Picoline-α-lactonitrile, i, 564.
Picolinic acid, αγ-dichloro-, preparation of, Trans., 408.
Picric acid, action of ethylic diazoacetate on, i, 140.
—— —— and anthracene, solubility relations of a mixture of, ii, 71.
—— —— and picrates, action of, on metallic cyanides, i, 132.
—— —— colorimetric estimation of, in its compounds with organic bases, ii, 64.
Picrylazoimide, i, 28.
Picrylhydrazine, derivatives of, i, 27.
Picrylhydrazopropane, i, 28.
Picylene diketone, i, 292.
—— ketone, i, 292.
Picylenecarbinol, i, 293.
Picylenemethane, i, 293.
Pigment, red of *Diemyctylus viridescens*, ii, 174.
Pimelic acid, conversion of, into cyclopentenedicarboxylic acid, i, 338.
—— —— $\alpha_1\alpha_2$-dibromo, i, 338.
γ-Pimelic acid, i, 448.
Pinacolinenitrimine, i, 445.
Pinacone prepared from acetophenone, i, 537.
Pinacone prepared from phenyl *p*-tolyl ketone, i, 537.
Pinacones, preparation of, by the reduction of aromatic ketone, i, 537.
Pinastric acid, i, 197.
Pine tar, i, 185, 294.
Pinene, i, 477.
—— constitution of, i, 428, 675.
Pines, German, resin of, ii, 365.
Pinole, constitution of, i, 60.
—— dibromide, action of reducing agents on, i, 60.
—— tribromide, i, 60.
—— —— ketone and secondary alcohol from, i, 60.
Pinonic acid, i, 478, 676.
Pinonic acid, oximes of, i, 478.
Pinoresinol, i, 109.
Pinus laricio, resin from, i, 109.
β-Pipecoline, action of hydrogen peroxide on, i, 479.
Piper ovatum, constituents of, Trans., 94.
Piperazines, i, 569.
Piperic acid, synthesis of, i, 42.
—— aldehyde, i, 464.
—— —— phenylhydrazone, i, 464.
Piperidine, action of inorganic chlorides on, i, 430.
—— action of, on bromothiophen, i, 681.
—— freezing point of, i, 272; ii, 207.
—— nitration of, i, 261.
—— thio-, i, 430.
—— vulpate, i, 99.
Piperidoacetic piperidide, i, 145.
Piperidylacetal, i, 479.
—— base from, i, 479.
Piperidylacetone, i, 479.
—— methiodide, i, 480.
—— phenylhydrazone, i, 480.
Piperidylacetoxime, i, 480.
Piperidylhydroxy-*iso*-butyramide, i, 682.
Piperidylhydroxy-*iso*-butyric acid, i, 681.
Piperine, synthesis of, i, 42.
Piperonylacraldehyde, i, 43.
—— condensation of, i, 468.
—— phenylhydrazone, i, 43.
Piperonylene, i, 468.
Piperonyleneacetone, i, 469.
—— phenylhydrazone, i, 469.
Piperonyleneacetophenone, i, 469.
—— phenylhydrazone, i, 469.
Piperonyleneacetoxime, i, 601.
Piperonylenemalonic acid, i, 468.
Piperonplenepyruvic acid, i, 469.
Piperonylideneacetone, i, 601.
—— dibromo-, i, 601.
Piperonylideneamidoacetal, i, 624.
Piperonylonitrile, amidoxime from, i, 36.
Piperonylvinylketocarboxylic acid, i, 469.
—— —— phenylhydrazone, i, 469.
Piperovatine, Trans., 98.
—— physiological action of, Trans., 99.
Pipette, valve-, ii, 525.
Pitchblende, helium from, Trans., 689.
Pituitary body, physiological action of extract of, ii, 405.
Plant cells, green, separation of oxygen by, ii, 26.
—— metabolism, place of tannins in, ii, 324.
—— pathology, chemical investigations in, ii, 524.

Plants, agricultural, foraging powers of some, for phosphoric acid, ii, 126.
—— alumina in, ii, 284.
—— assimilation of nitrates by, ii, 125.
—— cane-sugar in, ii, 53, 523.
—— carbonic anhydride exchanges of, ii, 520.
—— effect of chlorides on the growth of, ii, 175.
—— estimation of lecithin in, ii, 96.
—— etiolated, changes of composition in, during growth, ii, 124.
—— formation of pentosans in, i, 7.
—— glutamine in the green parts of, ii, 83.
—— green, detection of hydrogen peroxide in, ii, 239.
—— —— hydrogen peroxide in, ii, 26.
—— —— nutrition of, by glycerol, ii, 126.
—— higher, formation and decomposition of organic acids in, ii, 126.
—— localisation of oxalic acid in, ii, 129.
—— lower, action of dilute alkalis on, ii, 174.
—— mucin in, ii, 128.
—— nutrition of, by humus and organic substances, ii, 28.
—— occurrence and *rôle* of myrosin in, ii, 178.
—— origin of unsaturated compounds in, i, 640.
—— pentosans in, ii, 176.
—— presence of calcium citrate in, ii, 27.
—— reserve proteïn in, ii, 128.
—— respiration of, ii, 175.
—— richness of soil in nitrogen after the cultivation of various, ii, 178.
—— time of trehalose formation in, ii, 362.
—— transpiration and assimilation in, ii, 175.
Platinic pyrophosphate, formation of, Trans., 513.
Platinochlorides, attempt to estimate the nitrogen in, by Kjeldahl's method, ii, 290.
Platinoïd, thermo-electric properties of, ii, 152.
Platinomolybdates, ii, 230.
Platinosochlorides, preparation of, ii, 170.
Platinotungstates, ii, 229.
Platinous chloride, ii, 357.
Platinum arsenite, ii, 218.
—— bases, constitution of, ii, 400.
—— black, occlusion of oxygen and hydrogen by, ii, 492.
—— chloride, molecular refraction of dissolved, Trans., 836, 844.
Platinum condensation of electrolytic gas by, ii, 150.
—— selenide, ii, 391.
—— —— crystallisation of, ii, 391.
—— subchloride, probable existence of, ii, 170.
—— thermal conductivity of, ii, 69.
Platinum-ammonium compounds, ii, 400.
Platinum-antimony alloy, ii, 391.
Platinum-bismuth alloy, ii, 392.
Platosodiammoniodipyridine compounds, i, 557.
Platosodi-*iso*-undecylthiocarbamide, i, 324.
Platosoethylsulphine chloride, isomeric forms of, i, 488.
Platoso-*iso*-undecylthiocarbamide, i, 324.
Pleopsidic acid, i, 298.
Pleopsidium chlorophanus, pigments from, i, 298.
Pleural cavities, absorption of salt solutions from, ii, 321.
Plumbates of the alkaline earths, ii, 14.
Poisonous action of dicyanogen, ii, 129.
—— —— of the hydroxybenzenes on yeast and bacteria, ii, 130.
Poisons, arrow, ii, 123.
Polarisation, galvanic, thermodynamics of, ii, 198.
—— with solid and with liquid cathodes, ii, 67.
Polybasite, ii, 115.
Polycrase, helium from, Trans., 689.
Polygala, essence of roots of, ii, 364.
Polygala vulgaris, *P. depressa*, and *P. calcarea*, methylic salicylate in, ii, 177.
Polygonin, Trans., 1085.
Polygonum cuspidatum, constituents of the root of, Trans., 1084.
Polymerisation of liquid molecules, ii, 8.
Polymorphism, ii, 49.
Polynitro-derivatives, action of sodium and alkalis on, i, 653.
Polyporus betulinus, carbohydrate from, i, 323.
Polysterism, ii, 71.
Pomegranate root, alkaloïds from the rind of, i, 160.
Potassammonium, action of hydrogen phosphide on, ii, 75.
Potassium amidochromate, attempts to prepare, ii, 450.
—— —— non-existence of, ii, 272.
—— antimoniocitrate, Trans., 1030.
—— antimoniomalonate, Trans., 1035.
—— antimoniomucate, Trans., 1037.
—— antimony bromide, ii, 114.

Potassium antimony chloride, Trans., 516, ii, 114.
—— arseniocitrate, Trans., 1033.
—— arseniomucate, Trans., 1038.
—— arsenites, ii, 218.
—— assimilability of, in poor sandy soils by the action of nitrates, ii, 60.
—— bismuth sulphide, ii, 273.
—— bromide, melting point of, ii, 36, 339.
—— —— molecular refraction of dissolved, Trans., 837, 844, 865.
—— cadmium dichromate, ii, 355.
—— carbonate melting point of, ii, 36, 339.
—— chloride, freezing point of very dilute solutions of, Trans., 14.
—— —— melting point of, ii, 36, 339.
—— —— molecular refraction of dissolved, Trans., 836, 844, 864.
—— —— solution, volumes of, between 100° and 150°, ii, 307.
—— cupriferrocyanide, i, 487.
—— cuprocupricyanide, i, 486.
—— cuprocyanide cobaltocyanide, i, 486.
—— —— nickelocyanide, i, 486.
—— cupromanganocyanide, i, 486.
—— cuproferrocyanide, i, 406.
—— cyanate, detection of, in potassium cyanide, ii, 424.
—— cyanide, detection of potassium cyanate in, ii, 424.
—— —— solutions, action of, on gold and silver, Trans., 199.
—— dinitrosoferrothiosulphonate, ii, 317.
—— dodecairidite, ii, 504.
—— estimation of, ii, 245.
—— estimation of, by means of perchloric acid, ii, 444.
—— estimation of, in kainite, ii, 417.
—— estimation of, in manures, ii, 417.
—— *allo*-ethylic camphorate, electrolysis of, Trans., 337.
—— ferric chloride, ii, 165.
—— —— chromates, ii, 227.
—— ferricyanide, formation of, i, 197.
—— fluoroxymolybdate, ii, 19.
—— hexiridite, ii, 504.
—— hydrogen fluorides, heats of formation of, ii, 389.
—— —— iodate in volumetric analysis, ii, 525.
—— —— tartrate as material for standardising alkalis, ii, 289.
—— hypoiodite, velocity of reaction of, ii, 213.
—— iodide, action of ferric acetate on, ii, 111.
Potassium iodide, melting point of, ii, 36, 339.
—— —— molecular refraction of dissolved, Trans., 837, 845, 865.
—— iridium nitrites, action of heat on, ii, 503.
—— magnesium fluorides, ii, 351.
—— —— silicate, ii, 351.
—— manganichloride, ii, 46.
—— manganicyanide, i, 485.
—— manganocyanide, i, 485.
—— molybdosulphite, ii, 18.
—— nickelocyanide, action of reducing agents on, ii, 168.
—— nitrate and sodium chloride, saturated solutions of a mixture of, ii, 345.
—— —— molecular refraction of dissolved, Trans., 837, 845.
—— nitromethane, i, 123.
—— nitrososulphate, Trans., 452.
—— —— action of alcohol on, Trans., 1101.
—— —— alleged isomerism of, Trans., 1019.
—— oxysulphantimonate, Trans., 540.
—— permanganate, standardising, ii, 88.
—— phosphine, ii, 75.
—— phosphoduodecimolybdate, ii, 113.
—— platinochloride, reduction of, Trans., 984.
—— platinomolybdate, ii, 230.
—— *d*-propyoxysuccinates, Trans., 955.
—— rottlerin, Trans., 235.
—— salts, action of, on the herbage of meadows, ii, 458.
—— separation of rubidium from, ii, 319.
—— silicate, physiological action of, ii, 237.
—— silver sulphide, ii, 223.
—— sodium cobalt nitrite as a reagent for, ii, 87
—— sodium racemate, Wyrouboff's, ii, 485.
—— sulphate, estimation of, in wine, ii, 418.
—— —— freezing point of, Trans., 191.
—— —— melting point of, ii, 36, 339.
—— —— molecular refraction of dissolved, Trans., 838.
—— tartrarsenite, Trans., 104.
—— tetroxalate for use in alkalimetry, ii, 532.
—— titanofluoride, reduction of, with sodium, ii, 169.
—— zinc sulphate, molecular refraction of dissolved, Trans., 838.

Potatoes, effect of chlorides on the amount of starch in, ii, 61.
—— effect of mineral manures on the saline components of, ii, 130.
Potential differences between metals and electrolytes, ii, 35.
—— electric. See Electric potential.
Precipitates, crystallisation of, ii, 267.
—— in gelatinous solutions, ii, 491.
Pressure of solution as a means of determining the temperature of change, ii, 106.
—— volume and temperature relations of rarefied gases, ii, 38.
Propaldehyde and acetone, condensation of, i, 643.
—— polymeric modifications of, i, 200.
Propane, critical density of, ii, 379.
—— liquid, i, 77.
—— physical constants of, i, 1, 122.
Propionamide, heat of formation of, ii, 483.
Propionanilide, heat of formation of, ii, 483.
Propionates, nitroso-, preparation of, i, 330.
Propionic acid, affinity constant of, ii, 253.
—— —— bromo-, optically active, ethereal salts of, Trans., 914.
—— —— *α*-bromo-, i, 16.
—— —— chloro-, optically active, ethereal salts of, Trans., 914.
—— —— freezing point of, i, 273; ii, 207.
—— —— transformation of, into lactic acid, i, 197.
—— bromide, *α*-bromo-, i, 17.
Propionitrile, compounds of aluminium chloride with, i, 636.
—— physiological action of, ii, 238.
Propion-*m*-toluidide, i, 571.
Propionyl-*p*-methylisatic acid, i, 399, 400.
Propionyl-*p*-methylisatin, i, 399.
Propoxysuccinic acids, optically active, Trans., 944.
d-Propoxysuccinic acid, Trans., 954.
i-Propoxysuccinic acid, preparation of, Trans., 949.
—— —— resolution of, Trans., 952.
l-Propoxysuccinic acid, Trans., 954.
Propylacetamide, i, 495.
—— nitroso-, i, 495.
iso-Propylallylcarbinol, i, 198.
iso-Propylallylcarbinylic acetate, i, 198.
α-Propyl-*δ*-amidovaleraldehyde, i, 479.
Propylamyl, rotatory power of, ii, 97.
Propylbenzhydroxamic acids, i, 38.
α-*iso*-Propyl-*β*-*iso*-butylacraldehyde, i, 644.
Propylcarbamide, Trans., 563.
β-Propyl-*ε*-chloramylamine, i, 480.
Propylcyanal acetate, i, 258.
iso-Propylcymene, i, 644.
iso-Propylene-*p*-amidophenol, i, 87.
Propylenediamine, resolution of, into its optical components, i, 482.
Propylenediphenyldisulphone, i, 286.
Propylenedi-*p*-tolyldisulphone, i, 286.
Propylglyoxalidine, i, 481.
Propylic acetate, molecular surface energy of, ii, 40.
—— acetylmalate, rotatory power of, ii, 251.
—— alcohol, action of magnesium and of iron on, i, 405.
—— —— heat of vaporisation of, ii, 101.
—— —— oxidation of, with Fehling's solution, i, 198.
—— amylic ether, b. p., sp. gr., and rot. power of, i, 318.
—— *l*-bromopropionate, Trans., 922.
—— *d*-chloropropionate, Trans., 919.
—— cyanacetoacetate, i, 649.
—— diacetyltartrate, i, 174.
—— dibenzhydroxamates, i, 40.
—— dibenzoyltartrate, i, 268.
—— dibutyryltartrate, i, 174.
—— di-*iso*-butyryltartrate, i, 211.
—— dicaproyltartrate, i, 175.
—— dioxysuccinate, action of phenylhydrazine on, i, 173.
—— diphenylacetyltartrate, i, 268.
—— dipropionyltartrate, i, 174.
—— divaleryltartrate, i, 174.
—— di-*iso*-valeryltartrate, i, 211.
—— *d*-ethoxysuccinate, Trans., 973.
—— *l*-ethoxysuccinate, Trans., 973.
—— formate, molecular surface energy of, ii, 40.
—— hemipinates, i, 421.
—— *l*-lactate, Trans., 918.
—— malate, rotatory power of, ii, 251.
—— *l*-methoxysuccinate, Trans., 971.
—— *d*-phenylchloracetate, i, 451.
—— quinaldine-*β*-carboxylate and its methiodide, i, 112.
—— vulpate, i, 101.
iso-Propylic acetate, nitro-, i, 638.
—— alcohol, action of chlorine on, i, 259.
—— —— heat of vaporisation of, ii, 101.
—— —— nitro-, i, 638.
—— campholate, i, 295.
—— diacetyltartrate, i, 210.
—— *d*-ethoxysuccinate, Trans., 973.
Propylideneacetone, i, 643.
Propylideneacetoxime, i, 643.
Propylidenebenzoylhydrazine, i, 35.

β-Propylidenebutyrolactone, bromo-, i, 16.
iso-Propyllevulinic acid, i, 208.
β-Propylpheno-*m*-diazine, i, 250.
β-*iso*-Propylpheno-*m*-diazine, i, 250.
3 : 4-*iso*-Propylphenylpyrazole, i, 396.
Propylphenylsulphone, αβ-dibromo-, i, 229.
α-*iso*-Propylpiperic acid, i, 468.
β-Propylpiperidine, i, 480.
—— synthesis of, i, 480.
Propyltartronic acid, i, 335.
—— —— formation of, from dibutyryl dicyanides, i, 335.
iso-Propyltartronic acid, i, 335.
Propyl-*p*-tolylsulphone, αβ-dibromo-, i, 229.
Propylurea, Trans., 563.
Propylvulpic acid, i, 101.
Proteïd, estimation, densimetric, of, ii, 192.
—— estimation of, in urine, ii, 237.
—— physiological minimum, ii, 360.
Proteïds, action of, on solutions of glycogen, i, 124.
—— action of rennet and related ferments on, ii, 80.
—— coagulation of, by mechanical means, i, 254.
—— gastric digestion of, ii, 77.
—— &c., heat value of, ii, 51.
—— heat value of, in the organism, ii, 359.
—— in albuminuria, ii, 82.
—— influence of fats on the assimilation of, ii, 78.
—— of suprarenal capsules, ii, 236.
—— recognition and distinction of diverse, ii, 376.
—— reduction of alkaline copper solutions by, i, 690.
—— sparing influence of carbohydrates on, in nutrition, ii, 78.
—— sparing influence of gelatin on, in nutrition, ii, 78.
Proteïn, reserve, in plants, ii, 128.
Proteïn-like substances, artificial, i, 446.
Proteïnochromogen, ii, 233.
Proteoses in serous effusions, ii, 455.
Protochlorophyll, i, 389, 429.
Protochlorophyllane, i, 429,
Protophyllin, natural and artificial, i, 389.
Protophyscihydrone, i, 300.
Protophyscion, i, 300.
Prussian-blue, attempts to ascertain the constitution of, i, 486, 487.
Pseudaconitine, constitution of, Proc., **1895**, 154.
Ptomatine (Ptomaïne), i, 196.
Pulegonamine, i, 153.
Pulegone, i, 153.
—— hydrochloride, i, 380.
—— nitroso-, i, 380.
—— physical properties of, i, 673.
—— semicarbazide, i, 380.
Pulegoneoxime, i, 153.
Pulvamic acid, salts of, i, 100.
Pulvanilic acid and its salts, i, 100.
Pulvic acid, bromo-, i, 100.
—— —— constitution of, i, 100.
Pulvinone, i, 376.
Pulvodimethylamic acid, i, 100.
Pulvohydroxamic acid, i, 100.
Pulvomethylamic acid and its salts, i, 100.
Pulvo-α-naphthylamic acid and its salts, i, 100.
Pulvo-β-naphthylamic acid, i, 100.
Pulvophenylhydrazinic acid, i, 100.
Pulvopiperidinic acid, i, 100.
Pumpkin oil, analytical constants of, ii, 374.
Pyrazine and its derivatives, i, 569.
Pyrazinecarboxylic acid, i, 570.
Pyrazines, i, 569.
Pyrazole, action of nascent bromine on, i, 68.
—— phenyl derivatives of, i, 192.
1-Pyrazolecarbamide, i, 397.
1-Pyrazoleurethane, i, 397.
Pyrazoles, aromatic character of the, i, 397.
Pyrazole-series, i, 302.
—— —— isomerism in the, i, 303.
—— —— syntheses in the, i, 686.
Pyrazole-3 : 4 : 5-tricarboxylic acid, i, 688.
Pyrazoline and its derivatives, i, 248.
Pyrazolone, i, 624.
—— action of diazomethane on, i, 494.
—— derivatives from ethylic dioxysuccinate osazones, i, 172.
iso-Pyrazolone, constitution of, i, 432.
Pyrazolones, constitution of, i, 432.
Pyrazolonesulphonic acids, constitution of Walker's, i, 304.
Pyreneïte from Barèges, ii, 401.
Pyrethrine, Trans., 101.
Pyridazine, i, 301.
Pyridazinedicarboxylic acid, i, 301.
Pyridazinetetracarboxylic acid, i, 301.
Pyridazinones, i, 302.
Pyridazolone, i, 302.
Pyridazolone-4-carbonylhydrazine, i, 302.
Pyridazolone-4-carbonyl-*iso*-propylenehydrazine, i, 302.
"Pyridazolone-3-carboxylic acid," true constitution of, i, 302.
Pyridazolone-4-carboxylic acid, i, 302.
Pyridazolones, i, 302.

Pyridine, action of nascent bromine on, i, 68.
—— β-amido-, i, 391.
—— bromamido-, i, 391.
—— compound of, with lead bromide, i, 391.
—— derivatives, conversion of aliphatic oximes into, i, 562.
—— —— oxy-, Trans., 399.
—— —— synthesis of, from coumalin compounds, i, 557.
—— platinosammonio-compounds of, i, 557.
—— production of, in the roasting of coffee, i, 624.
$\alpha\alpha'$-Pyridinedicarboxylic acid, γ-chloro-, Trans., 402.
Pyridineplatinosammonium chloride, i, 557.
2-Pyridone, action of diazomethane on, i, 494.
c-Pyridylpyrroline, i, 627.
—— methiodide, i, 628.
1 : 3-Pyridylpyrroline, i, 627.
—— methiodide, i, 627.
2 : 3-Pyridylpyrroline, methiodide, i, 628.
Pyrites and marcasite, chemical characters of, ii, 316.
—— estimation of sulphur in, ii, 63, 291, 411.
Pyroantimonious acid, ii, 231.
Pyrochlore from Alnö, Sweden, ii, 509.
Pyrocomenic acid, chloro-, i, 22.
Pyrolusite, apparatus for the assay of, by Bunsen's process, ii, 88.
Pyromellitic acid, formation of, in the action of sulphuric acid on charcoal, i, 229.
—— —— formation of, from sugar, i, 164.
Pyrometers, platinum-resistance, determination of high temperatures by means of, Trans., 160.
Pyromucic acid, heat of formation of, ii, 436.
Pyronines, i, 146.
Pyropseudaconine, Proc., **1895**, 154.
Pyropseudaconitine, Proc., **1895**, 154.
Pyrotartaric acid, resolution of, into its optical components, i, 449.
Pyrrhoarsenite, ii, 76.
Pyrroline, action of nascent bromine on, i, 68.
—— compound of, with hydroferrocyanic acid, i, 390.
—— compound of, with symmetrical trinitrobenzene, i, 653.
—— compounds, synthesis of, from nitroso-ketones, i, 68.
Pyruvic acid, tribromo-, carbamide derivatives of, i, 12.
Pyruvic ureide, tribromo-, i, 13.
Pyruvic-α-naphthalide, i, 106.

Q.

Quercetin, constitution of, i, 554.
—— derivatives, Trans., 647; i, 387, 429, 584.
—— hydrobromide, Trans., 647.
—— hydrochloride, Trans., 648.
—— hydriodide, Trans., 648.
—— identity of sophoretin with, Trans., 31.
—— preparation of, Trans., 646.
—— sulphate, Trans., 647.
Quinacetophenoneoxime, Trans., 998.
Quinaldine, action of formaldehyde on, i, 71.
—— physiological action of, ii, 56.
Quinaldinealkine, i, 71.
Quinaldine-β-carboxylic acid, alkyl derivatives of, i, 112.
—— —— methochloride, i, 113.
—— —— methylbetaïne, i, 113.
Quinazolines, synthesis of, i, 571.
Quinine alkaloïds, i, 579.
—— hydrochlorosulphate, i, 434.
—— methohydroxide and salts, i, 579.
—— solubility of, in alkalis, ii, 299.
Quinizarin dimethyl ether, i, 232.
—— synthesis of, i, 232.
Quinol, action of phthalic chloride on, i, 219.
—— action of sulphuryl chloride on, i, 342.
—— dichloride, chlor-, i, 342.
—— *o*-dichloro-, and its dibenzoyl derivative, i, 342.
—— tetrachloro-compound of, with hydrazine, i, 28.
Quinoline, 4-amido, properties of, i, 70.
—— bases in brown-coal tar, i, 244.
—— benzyl hydrosulphide, i, 300.
—— —— sulphide, i, 300.
—— brom-4-amido-, i, 70.
—— 1 : 3 : 4-dibromamido-, i, 565.
—— —— methiodide, i, 565.
—— 1 : 3 : 4-dibromonitro-, i, 565.
—— compound of lead iodide with, i, 391.
—— 1 : 3-dibromo-, i, 565.
—— 1 : 4-dibromo-, i, 566.
—— 2 : 4-dichloro-, i, 392.
—— 2 : 4 : 1-dichloramido-, i, 392.
—— 2 : 4 : 1-dichloronitro-, i, 392.
—— ethiodide, 2′-amido-, i, 156.
—— freezing point of, i, 272; ii, 207.
—— in brown-coal tar, i, 392.
—— methiodide, 2′-amido, i, 156.
—— methochloride, 2′-amido-, i, 156.
—— —— 2′-iodo-, i, 156.

Quinoline, synthesis of, i, 155.
—— 1 : 3 : 4 : 3′-tetrabromo-, i, 566.
—— 1 : 3 : 4-tribromo-, i, 565.
—— 1 : 3 : 3′-tribromo, i, 565.
—— 1 : 4 : 3′-tribromo-, i, 566.
—— 1 : 2 : 4-trichloro-, i, 392.
Quinolineammonium bases, constitution of the so-called, i, 155.
Quinolinebenzenylamidoxime, i, 156.
Quinoline-3-sulphonic acid methylbetaïne, i, 112.
Quinoline-4-sulphonic acid methylbetaïne, i, 112.
Quinolinesulphonic acids, ethereal salts and betaïnes of, i, 111.
iso-Quinoline, [1 or 4], amido-, i, 684.
—— benzylochloride, i, 684.
—— chlor-, i, 530.
—— derivatives, i, 683.
—— —— synthesis of, i, 624.
—— ethiodide, amido-, i, 684.
—— ethobromide, amido-, i, 684.
—— iodo- and its derivatives, i, 301.
—— iodonitro-, i, 301.
—— methiodide, amido-, i, 684.
—— —— iodo-, i, 301.
—— synthesis of, i, 72.
—— tetriodide, i, 300.
iso-Quinolinecarboxylic acid hydrochloride of, i, 393.
iso-Quinolinesulphonic acid (1 or 4), i, 684.
iso-Quinolinesulphonic acid (3 or 2), i, 684.
Quinone, action of *o*-amidobenzoic acid on, i, 465.
—— constitution of, i, 655.
—— 3-nitro-, i, 513.
—— tetrachloro-, action of phosphorus pentachloride on, i, 24.
—— —— formation of from hexachlorophenol, i, 343.
—— ureide from, i, 425.
Quinone-bis-*o*-amidobenzoic acid, i, 466, 533.
—— —— nitroso-, i, 533.
—— —— reduction of, i, 534.
Quinonedioximes, stereoisomeric derivatives of, i, 217.
Quinones, action of carbamide on, i, 425.
α-Quinoquinolone, i, 245.
—— derivatives of, i, 244.
α-Quinoquinolone-*β*-carboxy-*o*-carboxyanilide, i, 245.
α-Quinoquinolone-*β*-carboxylate, i, 244.
Quinoxalinecarboxylic acid, amido-, i, 572.
Quinoxalinedicarboxylamic acid, i, 572.
Quinoxalinedicarboxylic anhydride, i, 572.

R.

Rabbits, contents of the stomach and intestines of at different periods after feeding, ii, 120.
—— poisoned by carbonic oxide, lactic acids in the urine of, ii, 175.
—— wild and tame, composition of the bones, teeth, &c., of, ii, 519.
Racemates, transition temperatures of, ii, 380.
Racemic acid, synthetical formation of, i, 21.
Racemism, i, 506.
—— and change of temperature on mixing liquids, ii, 485.
Rachitis, elimination of magnesium compounds in cases of, ii, 455.
Radiation of heat at low temperatures, ii, 123, 253.
Raffinose, action of the mucous membrane of the stomach and intestines on, ii, 403.
—— estimation of, ii, 425.
—— properties of, ii, 425.
Randia dumetorum, constituents of, i, 189.
Randia fat, i, 190.
Randia-red, i, 190.
Randiasapogenin, i, 190.
Randiasaponin, i, 189.
Randiatannic acid, i, 190.
Randic acid, i, 190.
Raphiospora flavovirescens, pigment from, i, 298.
Rate of escape of gases from solutions of varying concentration, Trans., 869, 983.
—— of oxidation of phosphorus, sulphur and acetaldehyde, ii, 213.
Reaction, velocity of. See Velocity of reaction.
Reactions, zone-, and their use in testing for acids, ii, 135.
Reflux condensation or distillation, apparatus for, ii, 260.
Refraction, atomic, of nitrogen, ii, 250.
—— —— of selenium, ii, 249.
—— equivalents and the periodic law, Proc., **1895**, 10.
—— molecular and atomic, ii, 429.
—— —— of dissolved salts and acids, Trans., 831.
—— of liquid oxygen, ii, 471.
—— of the CH_2-group, mean value of, ii, 65.
—— specific and molecular, new formulæ for, ii, 193.
Refractive indices of aqueous solutions of cadmium salts, ii, 33.
—— —— of solutions of sulphur and

phosphorus in carbon bisulphide, ii, 97.
Refractive powers of nitrogen compounds, ii, 194.
Refractometric observations, apparatus for, ii, 33.
—— researches, ii, 65,
Rennet and similar ferments, action of on proteïds, ii, 80.
Resacetophenone, action of methylic iodide on the potassium derivative of, i, 43.
—— behaviour of, in the animal organism, ii, 25.
Reseda odorata, oil of, i, 218.
Resin, estimation of, in soap, ii, 190.
—— from *Piper ovatum*, Trans., 96.
—— of German pines, ii, 365,
—— *Thapsia*, i, 385.
Resins, natural, i, 109.
Resorcinol, action of phthalic chloride on, i, 219.
—— action of zinc chloride on, i, 655.
—— condensation of, with glyoxylic acid, i, 171.
Resorcinolazo-γ-benzylic sulphide, i, 457.
β-Resorcylic acid, derivatives of, Trans., 990.
—— —— ethyl ether, Trans., 995.
—— —— ethylation of, Trans., 995.
—— —— methyl ether of, Trans., 994.
—— —— methylation of, Trans., 993.
Respiration, a new theory of, ii, 119.
—— leaf, ii, 175.
—— of green and etiolated leaves, ii, 176.
—— vegetable, ii, 520.
Respiratory exchanges, ii, 119.
Reuniol, i, 186.
—— acetate, i, 186.
Rhamnazin, Trans., 498.
—— constitution of, Trans., 500.
—— sulphate, Trans., 651.
Rhamnetin sulphate, Trans., 650.
Rhamnose, anhydrous, crystalline, i, 440.
Rhizocarpic acid, i, 298.
Rhizocarpon geographicum and *R. lecanorinum*, pigments from, i, 298.
Rhodinol, aldehyde and acid from, i, 78.
—— from oil of pelargonium, constitution of, i, 78.
Rhodium bases, constitution of, ii, 47.
Rhodochroisite from Asia Minor, ii, 505.
Rhus succedanea, sap of, i, 385.
Ricinelaidic acid, derivatives of, i, 126.
Ricinoleïc acid and its derivatives, constitution of, i, 125.
—— —— and oleïc acid, relations of, i, 647.
Ricinoleïc acid, constitution of, i, 81.
—— —— preparation of, i, 500.
iso-Ricinoleïc acid, i, 82.
Ricinoricinic acid, i, 82.
Ricinostearolic acid, i, 126.
—— —— constitution of, i, 81.
Ring systems, constitution of, i, 244.
Rock salt, occurrence of argon in the gases enclosed in, Proc., **1895**, 143.
Rocks containing carbonates, free alkaline earths in, ii, 171.
—— of the Karakoram Himalayas, ii, 51.
Root of *Polygonum cuspidatum*, constituents of, Trans., 1084.
Root-nodules of the alder (*Alnus glutinosa*), composition of, ii, 523.
—— —— —— —— influence of, on the fixation of nitrogen, ii, 522.
Rosaniline, acid, action of alkalis on, i, 423.
—— action of bromine on, i, 56.
—— action of hydrochloric acid on, i, 278.
—— constitution of, i, 56, 278.
—— methylation of, i, 667.
p-Rosaniline acetate, sulphone of, i, 285.
—— action of bromine on, i, 56.
—— compounds of, with mercury salts, i, 541.
—— constitution of, i, 234.
—— electrolytic conductivity of, and its derivatives, i, 540.
Rosanilines and their derivatives, basic properties of, i, 667.
—— constitution of, i, 540, 667.
Rosanilinesulphonic acids, i, 539.
Rose oil, examination of, for geranium oil, ii, 187.
Rosindone, amido-, i, 610.
—— nitro-, i, 610.
Rosinduline, i, 611.
Rosindulines, constitution of, i, 148.
Rotation, magnetic, of solutions of hydrogen chloride, ii, 196.
—— —— of the plane of polarisation of light in liquids, ii, 474.
—— molecular and molecular deviation, ii, 473.
—— optical, of ions, ii, 65.
Rotatory dispersion, determination of, by the aid of ray filters, ii, 1.
—— power and cryoscopic properties, connection between, ii, 194.
—— —— and molecular asymmetry of organic substances, ii, 1.
—— —— of active amylacetic acid and its derivatives, i, 203.
—— —— of amyl derivatives, i, 202, 318; ii, 149, 196, 472.

Rotatory power of amylic derivatives in the states of liquid and vapour, ii, 472.
—— —— of amylic ethers and salts, i, 318.
—— —— of amylic valerates, ii, 196.
—— —— of apoquinine, i, 688.
—— —— of camphorsulphonic bromides and chlorides, Trans., 354.
—— —— of chloro- and bromo-phenylacetic acids and their salts, i, 451.
—— —— of cinchonicine, i, 689.
—— —— of corydaline, Trans., 17.
—— —— of dissolved substances, ii, 194.
—— —— of ethereal acidyltartrates, ii, 195.
—— —— of ethereal chloro- and bromo-malates, i, 451.
—— —— of ethereal chloro- and bromo-propionates, i, 451.
—— —— of ethereal chloro- and bromo-succinates, i, 450.
—— —— of ethereal diacidyltartrates, i, 173—175, 211.
—— —— of ethereal β-methyladipates, i, 448.
—— —— of ethereal malates and acetylmalates, ii, 251.
—— —— of ethereal methoxy- and propoxy-succinates, Trans., 957.
—— —— of ethereal salts derived from active amylic alcohol, i, 202.
—— —— of ethereal salts of α-hydroxybutyric acids, i, 410; ii, 471.
—— —— of ethereal salts of optically active lactic and chloro- and bromo-propionic acids, Trans., 917.
—— —— of ethereal salts of sarcolactic acid, Proc., 1895, 54.
—— —— of ethereal tartrates, ii, 338.
—— —— of halogen derivatives of camphor, Trans., 372.
—— —— of metallic lactates, ii, 174.
—— —— of metallic salts of active lactic acids, Trans., 616.
—— —— of methoxy- and propoxy-succinic acids, Trans., 949.
—— —— of octacetylmaltose, Trans., 214.
—— —— of *l*-propylenediamine, i, 482.
—— —— of saturated hydrocarbons containing the active amyl radicle, ii, 97.
Rottlerin, a dyeing property of, Trans., 238.
—— action of nitric acid on, Trans., 230.
—— action of sodium carbonate on, Trans., 237.
—— metallic derivatives of, Trans., 233—236.
Rottlerin, molecular weight of, Trans., 233.
—— oxidation and reduction of, i, 429.
Rottlerone, Trans., 237.
Rubber goods, analysis of, ii, 191.
Rubidium chloride, molecular refraction of dissolved, Trans., 836, 844.
—— dinitrosoferrothiosulphonate, ii, 451.
—— ferric bromide, ii, 165.
—— —— chloride, ii, 165.
—— gold chloride, ii, 319.
—— heptanitrosoferrothiosulphonate, ii, 451.
—— iodide, m. p. of, ii, 36.
—— separation of potassium from, ii, 319.
—— sulphate, molecular refraction of dissolved, Trans., 838.
—— thallium bromides, ii, 399.
—— —— chlorides, ii, 398.
—— —— iodide, ii, 399.
Rubifuscine, i, 221.
Rutile, artificial, preparation of, ii, 21.
—— ilmenite and sphene, genetic relations of, ii, 400.
Rutin, identity of sophorin with, Trans., 32.
Rye grain, effect of manure, season, and seed on the composition of, ii, 179.

S.

Saccharimetry, correction for the volume of a precipitate held in suspension in, ii, 135.
"Saccharin," crystallography of, Trans., 985.
Saccharomyces Marxianus, enzyme of, ii, 322.
Saccharomycetes, fermentation of polysaccharides by, ii, 322.
Safranine from *m*-diamido-*p*-ditolylamine and quinone dichlorimide, i, 220.
—— Jaubert's and its diazo-derivative, i, 279.
Safranines, constitution of, i, 148, 219, 278, 462, 527.
—— relations of, to the mauveïnes and indulines, i, 527.
Safraninone, i, 219.
—— from diamidodurene and *m*-amidoditolylamine, i, 462.
Safranol, i, 219.
—— ethyl ether, i, 610.
—— methyl ether, i, 610.
Safranone, i, 219.
iso-Safroleazoxime, i, 36.
iso-Safroledioxime, derivatives of, i, 36.

Salicylaldehyde, heat of formation of, ii, 436.
Salicylic acid, detection of, in wines, ii, 426.
—— —— estimation of, ii, 297.
—— —— β-nitro-, i, 179.
—— —— —— bismuth salts of, i, 179.
—— —— rate of etherification of, i, 228.
Salicyloacetic acid, i, 45.
Salicylscopoleïne, i, 632.
Saligenol, action of, on aromatic diamines, i, 346.
—— heat of formation of, ii, 436.
Saliva, action of, on starch, ii, 403.
Salivary glands of the leech, ii, 53.
Salt solutions, aqueous, volume of between 100° and 150°, ii, 307.
—— —— thermoelectric properties of, ii, 68.
Salts, action of the cathode discharge on, ii, 150.
—— coagulation of arsenious sulphide solutions by, Trans., 63.
—— dissolved, molecular refraction of, Trans., 831.
—— ethereal, molecular surface energy of, ii, 40.
—— —— rate of hydrolysis of, ii, 107.
—— fused, direct spectrum analysis of, ii. 470.
—— isomorphous, melting points of mixtures of, ii, 37.
—— —— solubility of mixed crystals of pairs of, ii, 7.
—— organic, dependence of the electrical conductivity of, on the temperature, ii, 4.
—— saturated solutions of two or more, ii, 345.
—— solutions of, in organic liquids, law of solubility of, ii, 256.
—— sparingly soluble, heats of solution and dissociation of, ii, 435.
—— superfused, solubility of, ii, 488.
—— —— specific heat of, ii, 482.
—— volume of, in their aqueous solutions, ii, 486, 487.
Salvone, identity of, with thujone, i, 619.
Samarskite, helium from, Trans., 687.
Sambucus nigra, existence of coniine in, i, 433.
Sand of the Dunes of Holland, mineralogical and chemical composition of, ii, 117.
Sap of the lac tree, i, 385.
Sarcolactic acid, ethereal derivatives of, Proc., **1895**, 54.
—— —— rotatory powers of the ethereal derivatives of, Proc., **1895**, 54.
Sarcosine, i, 175.
Sarcosine, nitro-, i, 176.
—— nitroso-, i, 176.
Scammony resin, i, 109.
Scarlet acid, i, 388.
Scatole, compound of, with symmetrical trinitrobenzene, i, 653.
—— synthesis of, i, 155.
Schizo-saccharomyces octosporus, enzyme of, ii, 322.
"Schneebergite," the so-called, ii, 512.
Schotten-Baumann method, convenient modification of, i, 139.
Scolecite, from Black Lake, Quebec, ii, 116.
Scopolamine and its salts, i, 158.
—— ethiodide, i, 158.
—— methiodide, i, 158.
—— methohydroxide, i, 158.
—— inactive and its salts, i, 159.
Scopoleïne, i, 632.
Scopoline, i, 159.
"Scrophularacrin," real nature of, ii, 410.
Scrophularia nodosa, constituents of, ii, 410.
Scrophularin, non-existence of, ii, 410.
"Scrophularosamine," real nature of, ii, 410.
Sea of Marmora, water of the, ii, 515.
Sea-bottom deposits from the Eastern Mediterranean, ii, 51.
Sebacic acids, dibromo-, i, 267.
Secalose, i, 165.
Seed oils, analytical properties of, ii, 247.
Seedlings, crystalline nitrogenous constituents of, ii, 84.
Seeds, agricultural, organic bases occurring in, ii, 364.
—— analysis of, ii, 192.
—— germination of, ii, 521.
—— of *Diospyros kaki*, mannan as a reserve material in, ii, 128.
—— of the Moâbi, ii, 285.
Selenides, natural, spectra of, ii, 338.
Selenious acid, estimation of, by means of potassium permanganate, ii, 461.
Selenitines, i, 8.
Selenium, atomic refraction of, ii, 249.
—— compounds, aromatic, i, 413.
—— detection and estimation of, in meteoric iron, ii, 369.
—— spectrum of, ii, 338.
Semicarbazide, i, 251.
Semiorthoxalylopiperidide, i, 170.
Senecine, i, 632.
Senecio vulgaris, alkaloïds from, i, 632.
Senecionine, i, 632.
Serous effusions, albumoses in, ii, 81.
—— —— proteoses in, ii, 455.
Serpentine, action of dry hydrogen chloride on, ii, 166, 316.

Serpentine of the Binnenthal, ii, 117.
Serum, blood, determination of the osmotic pressure of, by the cryoscopic method, ii, 7.
Sesame cake, effect of feeding with, on butter, ii, 299.
Sesquiterpene from essence of cananga, i, 426.
—— from essence of Ylang-ylang, i, 243, 294.
—— from oil of *Cannabis indica*, i, 623.
—— from oil of hops, Trans., 59.
Shaking apparatus, ii, 216.
Silica, reduction of, by aluminium, ii, 447.
—— reduction of, by carbon, ii, 497.
—— volatilisation of, ii, 497.
Silicates, crystallochemical theory of the ii, 22.
—— decomposition of, by lead carbonate, ii, 330.
—— estimation of, ii, 325.
Silicon, amorphous, ii, 263.
—— —— preparation of, ii, 222.
—— —— properties of, ii, 263.
—— analysis of, ii, 264.
—— composition of various preparations of, ii, 264.
—— crystalline, ii, 447.
—— —— combustibility of, ii, 264.
—— displacement of carbon from fused cast iron by, ii, 220.
Silico-spiegel, estimation, volumetric, of manganese in, Trans., 274.
Silver acetylide, compound of, with silver nitrate, i, 635.
—— action of, on fused ammonium salts, Proc., **1895**, 114.
—— amalgam, remarkable molecular change in, Trans., 239.
—— and mercury, double salts of, containing cyanogen, i, 581.
—— arsenites, ii, 218.
—— bismuth sulphide, crystallisation of, ii, 391.
—— colloïdal, ii, 45.
—— cyanide, solubility of, ii, 478.
—— dichromate mercury cyanide, ii, 355.
—— estimation of, in iron and steel, ii, 536.
—— freezing point of, Trans., 188, 1024, 1027, 1028.
—— fulminate, action of ethylic iodide on, i, 12.
—— *d*-lactate, Trans., 627.
—— mercury cyanonitrates, i, 581.
—— metallic solutions of, ii, 166.
—— nitrate and urea, interaction of, Trans., 765.
Silver nitrate, molecular refraction of dissolved, Trans., 837, 845, 865.
—— organosol of, with ethylic alcohol, ii, 45.
—— ornaments from Inca graves at Chimbote, Peru, chemical composition of, Trans., 242.
—— potassium sulphide, ii, 223.
—— recovery of, from solutions, ii, 500.
—— rottlerin, Trans., 236.
—— selenide, crystallisation of, ii, 391.
—— separation of arsenic antimony or tin from, ii, 89.
—— separation of manganese from, ii, 423.
—— sodium sulphide, ii, 223.
—— solubility of, in solutions of potassium cyanide, Trans., 204.
—— specific ionic velocity of, ii, 477.
—— sulphide, ii, 223.
—— —— crystallisation of, ii, 390.
—— thermal conductivity of, ii, 69.
—— thioformohydroxamate, i, 11.
—— thiohypophosphate, ii, 13.
—— titration of, with sodium sulphide, ii, 64.
—— trihydrogen fluoride, ii, 389.
—— triiodide, i, 581.
Silveracetylcarbamide, i, 270.
Silver-ammonia compounds, ii, 222.
Silverformylcarbamide, i, 270.
Silver-gold-tin-zinc alloys, assay of, ii, 295.
Skeleton, influence of acid fodder on, ii, 517.
Skin of *Alburnus lucidus*, silvery substance of the, ii, 279.
Slag, basic, estimation of citrate-soluble phosphoric acid in, ii, 243.
—— —— genuine, ii, 86.
Slags, estimation of iron in, ii, 420.
Smithsonite from Marion Co., Arkansas, ii, 510.
Soap, estimation of resin in, ii, 190.
Soda, commercial caustic, vanadium in, ii, 49.
Sodalite, constitution of, ii, 358.
Sodamide derivatives, syntheses with, i, 289.
—— heat of dissolution of, ii, 499.
—— preparation and properties of, ii, 499.
Sodammonium, action of hydrogen phosphide on, ii, 75.
Sodium acetate, heat of dissolution of, ii, 255.
—— acetylide, heat of formation of, ii, 482.
—— alkyloxides, reducing action of, i, 601.
—— ammonium auropyrophosphomolybdate, ii, 275.

Sodium ammonium manganese pyrophosphotungstate, ii, 230.
—— —— tartrates, transition temperature of, ii, 380.
—— —— tungstates, ii, 503.
—— antimoniocitrate, Trans., 1031.
—— arseniocitrate, Trans., 1034.
—— arsenites, ii, 218.
—— auramine pyrophosphate, ii, 274.
—— bromide, m. p. of, ii, 36, 339.
—— carbonate, freezing point of, Trans., 191.
—— —— melting point of, ii, 36, 339.
—— —— solution volumes of, between 100° and 150°, ii, 307.
—— chlorate, molecular refraction of dissolved, Trans., 838.
—— chloride and potassium nitrate, saturated solutions of admixed, ii, 345.
—— —— effect of the intravenous injection of, on the composition of blood and lymph, ii, 173, 362.
—— —— freezing points of solutions of, ii, 156.
—— —— melting point of, ii, 36, 339.
—— —— molecular refraction of dissolved, Trans., 835, 844, 864.
—— —— reduction of the freezing point of dilute solutions of, ii, 206.
—— —— solution, volumes of between 100° and 150°, ii, 307.
—— cobalt triphosphate, ii, 446.
—— cupriferrocyanide, i, 406.
—— cuproferrocyanides, i, 406.
—— cupromanganocyanide, i, 486.
—— detection and estimation of, in lithium salts, ii, 532.
—— detection of, by means of dihydroxytartaric acid, Trans., 48.
—— dinitrosoferrothiosulphonate, ii, 317.
—— ferrofulminate, i, 12.
—— gold sulphide, ii, 274.
—— hydrogen sulphide, electrolysis of, ii, 500.
—— —— sulphite, effect of severe cold on solutions of, ii, 349.
—— hydroxide, volumes of aqueous solutions between 100° and 150°, ii, 307.
—— hyposulphite, ii, 500.
—— iodide, melting point of, ii, 36, 339.
—— lead iodide, ii, 268.
—— manganese pyrophosphomolybdates, ii, 230.
—— —— pyrophosphotungstates, ii, 230.
—— molybdosulphite, ii, 18.
—— nickel triphosphate, ii, 446.
Sodium nitroethane, constitution and reactions of, i, 3.
—— nitromethane, i, 123.
—— nitrososulphate, Trans., 1095.
—— peroxide, action of nitrous oxide on, ii, 312.
—— —— analysis of, ii, 185.
—— phosphotungstate, a new, ii, 275.
—— platinotungstates, ii, 229.
—— potassium racemate, Wyrouboff's, ii, 485.
—— press as modified by E. Beckmann, ii, 163.
—— pyrophosphates, ii, 14.
—— rottlerin, Trans., 233.
—— silver sulphide, ii, 223.
—— sulphate, freezing point of, Trans., 191.
—— —— melting point of, ii, 36, 339.
—— —— molecular refraction of dissolved, Trans., 838, 866.
—— —— solution, volumes of between 100° and 153°, ii, 307.
—— sulphide, estimation of the heavy metals by titration with, ii, 64.
—— tartrarsenite, Trans., 103.
—— thallium chloride, ii, 399.
—— thiosulphate, cause of the fugitiveness of photographs fixed by, ii, 349.
—— —— for standardising iodine solutions, ii, 63.
—— —— specific heat of, ii, 482.
—— triphosphate, ii, 446.
—— zinc triphosphate, ii, 447.
Sodiumphosphine, ii, 75.
Soil and its produce, effect of sulphurous acid on, ii, 366.
—— behaviour of phosphoric acid soluble in water towards the absorbent constituents of, ii, 524.
—— cultivated, drainage from, ii, 133.
—— estimation of calcium and magnesium carbonates in, ii, 245.
—— estimation of free ferric oxide in, ii, 293.
—— peaty, peculiar property of phosphoric acid in, ii, 285.
—— poor sandy, assimilability of potassium in, by the action of nitrates, ii, 60.
—— richness of, in nitrogen after the cultivation of various plants, ii, 178.
Soils from South India, composition of, ii, 366.
—— of arid and humid regions, amount of nitrogen in the humus of, ii, 367.
—— Silesian, i, 178.
Solid and liquid phases, equilibrium between, ii, 158.
Solids, determination of the specific gravity of, ii, 485.
—— dissolution of, in vapours, ii, 255.

Soloric acid, i, 297.
Solorina crocea, pigment of, i, 297.
Solubility, experiments on, ii, 207.
—— in mixtures of alcohol and water, ii, 308.
—— increase of, by the addition of non-electrolytes, ii, 382.
—— melting and boiling points, change of, ii, 107.
—— of benzene derivatives in water, ii, 489.
—— of double compounds, ii, 71.
—— of mixed crystals of pairs of isomorphous salts, ii, 7.
—— of solid non-electrolytes in mixtures of alcohol and water, ii, 156.
—— of superfused salts, ii, 488.
"Solute," ii, 157.
Solution and pseudo-solution, Trans., 63.
—— existence of hydrates and of double compounds in, Proc., **1895**, 87.
—— pressure of, as a means of determining the temperature of change, ii, 106.
—— volumes, atomic and molecular, ii, 70.
Solutions, aqueous, electrical conductivity in, ii, 252.
—— —— thermal expansion of, ii, 339.
—— —— volume of salts in, ii, 486, 487.
—— concentrated, freezing points of, ii, 71.
—— dilute, absorption spectra of, ii, 433, 471.
—— —— experimental proof of the laws of van't Hoff, Arrhenius, and Ostwald for, ii, 105.
—— —— freezing points of, ii, 155.
—— —— new method of determining the freezing point of, Trans., 1.
—— —— of small conductivity, electrical conductivity and convection in, ii, 252.
—— gelatinous, precipitation in, ii, 491.
—— of calcium chloride, freezing points, heat of dissolution, and densities of, ii, 208.
—— of salts in organic liquids, law of solubility of, ii, 156.
—— of ternary mixtures, ii, 157.
—— of varying concentration, rate of escape of gases from, Trans., 869, 983.
—— saline, aqueous, volumes of, between 100° and 150°, ii, 307.
—— —— thermoelectric properties of, ii, 68.
—— saturated, ii, 344.
Solutions, saturated, of two or more salts, ii, 345.
—— solid, molecular weight determinations in, ii, 439.
Solvent, cryoscopic behaviour of substances having constitutions similar to that of the, ii, 205.
Solvents, maximum depression of the freezing point of, ii, 105.
—— organic, electrolytic dissociation and the law of dilution in, ii, 302.
Sophora japonica, yellow colouring matter of, Trans., 30.
Sophoretin, identity of, with quercetin, Trans., 31.
Sophorin, identity of, with rutin, Trans., 32.
Sophorine, identity of, with cytisine, i, 159.
Sordidin, i, 388.
—— polymeride of, i, 388.
—— products of reduction of, i, 388.
Specific gravity of solids, determination of, ii, 485.
Specific heat. See Heat, specific.
Specific inductive capacity. See Inductive capacity, specific.
Specific volume. See Volume, specific.
Spectra, absorption, of dilute solutions, ii, 432, 471.
—— flame, at high temperatures, ii, 432.
—— of carbon electrodes, variation in, ii, 432.
—— of gases from clèveite, ii, 431.
—— —— —— obtained, from various minerals, ii, 430.
—— of metallic manganese, its alloys and other compounds, ii, 433.
—— of oxygen, possible explanation of the two-fold, ii, 469.
—— of selenium and natural selenides, ii, 338.
Spectroscopic phenomena of the Bessemer process, ii, 432.
Spectrum, absorption, of iodine, ii, 193.
—— —— of liquid air, ii, 471.
—— analysis, direct, of minerals and fused salts, ii, 470.
—— fluorescence of argon, ii, 469.
—— —— —— —— resemblance of, to that of the Aurora borealis, ii, 337.
—— of helium, Trans., 687, 698, 1108.
—— —— —— gas showing the, ii, 498.
—— of methæmoglobin, i, 256.
—— of the electric discharge in liquid oxygen, air, and nitrogen, ii, 33.
—— of the gas from clèveite, Trans., 1108.
Spessarite, from Llano Co., Texas, ii, 511.

Sphene, ilmenite and rutile, genetic relations of, ii, 400.
Spiegeleisen, estimation, volumetric, of manganese in, Trans., 274.
Spike, oil of, rotatory power of, i, 294.
Spinel, artificial, ii, 275,
Splenic cells, at different ages, percentage of sulphur and phosphorus in, ii, 54.
Stannic and metastannic acids, ii, 448.
Stannic bromide, preparation and properties of, ii, 448.
—— chloride, and hydrogen sulphide, reaction of, in the gaseous state, ii, 225.
—— —— volatility of, ii, 140.
—— iodide, solubility of, in carbon bisulphide at low temperatures, ii, 489.
Stannous chloride and ferric chloride, velocity of reaction between, ii, 257.
—— diammonium chlorides, ii, 11.
—— oxide, action of nitrous oxide on, ii, 312.
Starch, a second achroodextrin obtained by the action of diastase on, i, 409.
—— action of diastase on, Trans., 702, 739.
—— action of diastase prepared from kiln dried malt on, Trans., 707, 744.
—— combination of, with water, i, 165.
—— comparison of the ferment actions of saliva, pancreatic juice, intestinal juice, and blood on starch, ii, 403.
—— dissolved, molecular structure of, i, 199.
—— effect of chlorides on the amount of, in potatoes, ii, 61.
—— estimation of, ii, 189, 426.
—— estimation of, by alcoholic fermentation, ii, 144.
—— estimation of, in compressed yeast, ii, 93.
—— fractionation of the products of hydrolysis of, Trans., 717.
—— influence of, on metabolism, ii, 516.
—— iodide of, i, 79, 199, 313, 322, 587.
—— oxidation of, i, 587.
—— paste, action of diastase on, in the cold, Trans, 309.
—— potato, combination of iodine with, i, 587.
—— resolution of, by the action of oxalic acid, i, 491.
—— steeping of, i, 165.
Staurolite, chemical nature of, ii, 51.
Stearolic acid, action of fused potash on, i, 126.
—— —— constitution of, i, 648.
Stearoxylic acid, i, 208.
Steel, analysis of, ii, 420.
—— boron, ii, 269.
—— estimation of carbon in, ii, 86.
Steel, estimation of gold and silver in, ii, 536.
—— estimation of iron in, ii, 530.
—— estimation of sulphur in, ii, 244, 411.
—— estimation of the carbide carbon in, ii, 292.
—— estimation of the total carbon in, ii, 292.
—— estimation, volumetric, of manganese in, Trans., 275.
—— estimation, volumetric, of phosphorus in, ii, 30, 414.
—— nickel-, estimation of nickel in, ii, 421.
Steels, temperatures of transformation of, ii, 110.
Stereochemistry, some points in, i, 108. 243.
Stereoisomerides, nomenclature of, i, 489.
Stilbene, *o*-diamido, *cis*- and *trans*-modifications of, i, 534.
—— *o*-dinitro-, *cis*- and *trans*-modifications of, i, 534.
Stirring apparatus, ii, 21, 163, 216.
Stomach, analysis of the contents of the, ii, 77.
—— contents of the healthy, ii, 77.
—— estimation of hydrogen chloride in the contents of the, ii, 526.
—— hydrochloric acid in the, ii, 77.
—— thiocyanic acid in the juices of the, ii, 361.
Stopcocks, glass, improved forms of, ii, 345.
Strontium, atomic weight of, ii, 314.
—— arsenites, ii, 218.
—— bromide, properties of, ii, 314.
—— —— solubility of, in alcohol, ii, 223.
—— chloride, m. p. of, ii, 36, 339.
—— —— molecular refraction of dissolved, Trans., 836, 844, 864.
—— cupriferrocyanide, i, 407.
—— cuproferrocyanide, i, 407.
—— estimation, volumetric of, ii, 327.
—— iodide, heat of formation of, ii, 342.
—— *l*-lactate, Trans., 626.
—— oxybromide, ii, 500.
—— rottlerin, Trans., 235.
—— salts, action of, on the animal organism, ii, 53.
—— separation, qualitative, of barium and calcium from, ii, 461.
—— tartrarsenite, Trans., 105.
Strychnine, detection and estimation of, in corpses, ii, 542.
—— discrimination of, from atropine, ii, 467.
—— *d*-ethoxysuccinate, Trans., 965.
—— *l*-ethoxysuccinate, Trans., 965.

Strychnine, *l*-ethoxysuccinate, acid, Trans., 964.
—— *l*-methoxysuccinate, Trans., 964.
Stylolites, ii, 23.
Styryl methyl ketone, 3 : 6-bromonitro-, i, 288.
"*β*-Sublimonaphthol," i, 86.
Substitution in mineral chemistry, thermochemical researches on, ii, 341.
Succinaminehydroxamic tetracetate, i, 393.
Succinanil, action of phosphorus pentachloride on, i, 176.
—— constitution of, i, 177.
—— tetrachloro-, i, 177.
Succinhydrazide, i, 264.
Succinic acid, chloro-, lævorotatory, formation of, Trans., 494.
—— —— dibromo-, m. p. of, ii, 379.
—— —— dichloro-, i, 20.
—— —— diketohexamethylene from, i, 339.
—— —— trichloro-, i, 20.
—— acids, alkylated, separation and identification of, i, 504.
—— —— chlorinated, i, 19.
—— anhydride, *d*-chloro-, i, 450.
—— chloride, *d*-chloro-, i, 450.
iso-Succinic acid, dibromo-, i, 20.
Succinimide, action of nitrosyl chloride on, Trans., 491.
—— behaviour of, in the animal organism, ii, 280.
—— electrolysis of, i, 209.
Succinite, i, 384.
Succinoabietic acid, i, 384.
Succinoabietol, i, 385.
Succinoresinol, i, 385.
Succinosilvic acid, i, 385.
Succinyl-*ab*-dimethyldiphenyldithiourea, symmetrical, Trans., 570.
Succinyl-*ab*-di-*α*-naphthyldithiocarbamide, Trans., 569.
Succinyl-*ab*-di-*α*-naphthyldithiourea, Trans., 569.
Succinyl-*ab*-diphenyldibenzyldithiourea, symmetrical, Trans., 570.
Succinyl-*ab*-diphenyldisemithiocarbazide, Trans., 571.
Succinyl-*ab*-diphenyldithiocarbamide, Trans., 566.
Succinyl-*ab*-diphenylthiourea, Trans., 566.
Succinyldithiocarbimide, Trans., 565.
—— action of alcoholic ammonia on, Trans., 573.
—— action of water on, Trans., 572.
—— derivatives of, Trans., 565.
Succinyl-*ab*-di-*o*-tolyldithiocarbamide, Trans., 569.
Succinyl-*ab*-di-*o*-tolyldithiourea, Trans., 569.
Sulfoborite, ii, 276.
Sugar, apparent presence of, in the urine of persons taking sulphonal, ii, 406.
—— as the source of muscular work, ii, 233.
—— cane-, action of acetic and hydrochloric acids on, ii, 297.
—— —— crystallisable, estimation of, in raw sugars, ii, 93.
—— —— decomposition products of, i, 164.
—— —— estimation of, in beer wort, ii, 93.
—— —— estimation of, in presence of commercial glucose, ii, 296.
—— —— formation of mellitic and pyromellitic acids from, i, 164.
—— —— freezing points of solutions of, ii, 156.
—— —— in plants, ii, 523.
—— —— inversion of, in the small intestine, ii, 405.
—— —— oxidation of, i, 443, 587.
—— —— oxidation of, by potassium permanganate, i, 443.
—— —— oxidation of, by manganic oxide, i, 443.
—— —— solutions, temperature of maximum density and freezing points of, ii, 343.
—— detection of, in urine, ii, 334.
—— detection of small quantities of, in urine, ii, 537.
—— estimation, gravimetric of, by means of alkaline copper solutions, ii, 91.
—— estimation of, by Fehling's solution, ii, 142.
—— from indican, i, 96, 189.
—— in blood after bleeding, ii, 24.
—— in urine, source of, ii, 360.
—— invert, influence of normal or basic lead acetate on, ii, 143, 296.
—— juice, amount of lime and magnesia in, i, 79.
—— of *Agave Americana*, ii, 363.
—— procedure in Fehling's titration for, ii, 187.
Sugar-group, syntheses in the, i, 79.
Sugars, acetates derived from, i, 321.
—— action of phloroglucinol on, i, 164.
—— action of the enzymes of yeast on, i, 162.
—— combinations of, with primary hydrazines, i, 409.
—— compounds of, with alcohols and ketones, i, 437.
—— estimation, volumetric, by means of an ammoniacal copper solution, Proc., 1895, 43.
—— formation of glycogen from, ii, 360.

Sugars, purification of, i, 260.
—— raw, estimation of alkalinity of, ii, 532.
—— —— estimation of crystallisable sugar in, ii, 93.
—— variations in, during the germination of barley, ii, 363.
Sulphanilic acid, thio-derivatives of, PROC., **1895**, 141.
Sulphantimonic acid, TRANS., 542.
Sulphate group, specific ionic velocity of, ii, 477.
Sulphates, decomposition of, by ammonium chloride, ii, 185.
—— ethereal hydrogen, in urine, ii, 55.
—— insoluble, estimation of sulphuric acid in, ii, 137.
Sulphides of aromatic bases, i, 300.
o-Sulphobenzanil, i, 473, 474.
o-Sulphobenzanilic acid, i, 473.
m-Sulphobenzoic acid, *p*-chloro-, derivatives of, i, 181.
o-Sulphobenzoic acid, isomeric chlorides of, i, 472, 473, 474.
—— anilides, i, 473, 474.
—— chlorides, action of aniline on, i, 473, 474.
—— —— separation of, i, 474.
o-Sulphobenzo-*m*-tolil, i, 473.
o-Sulphobenzo-*o*-tolil, i, 473.
o-Sulphobenzo-*p*-tolil, i, 473.
o-Sulphobenzo-*p*-tolilic acid, i, 473.
o-Sulphobenzo-*o*-toluidide, i, 473.
o Sulphobenzo-*m*-toluidides, i, 473.
o-Sulphobenzo-*p*-toluidides, i, 473.
Sulphocamphylic acid, PROC., **1895**, 23; i, 154.
—— —— fusion of, with potash, PROC., **1895**, 24.
Sulphohydrazimethylenecarboxylic acid, potassium salt of, i, 642.
Sulphomolybdic acid, salts of, ii, 18.
Sulphonal, apparent presence of sugar in the urine of persons taking, ii, 406.
Sulphones, aromatic, i, 284.
—— —— constitution of, i, 286.
—— synthesis of, i, 337.
—— unsaturated, i, 229.
Sulphonic acids, hydrolysis of the ethereal salts of, i, 370.
o-Sulpho-*p*-toluic acid, phthaleïns of, i, 183.
Sulphur, addition of, to unsaturated organic compounds, i, 509.
—— and carbon, combination of nitrogen with, ii, 495.
—— atomic refraction of, ii, 430.
—— chloride vapour, electrolysis of, ii, 476.
—— combination of iodine with, ii, 163.
Sulphur compounds in the atmosphere, attempts to estimate, PROC., **1894**, 218.
—— estimation of, ii, 184.
—— estimation of, in iron, ii, 244, 411, 527, 528.
—— estimation of, in organic substances, ii, 136, 182, 244.
—— estimation of, in organic compounds with sodium peroxide, ii, 244.
—— estimation of, in petroleum, ii, 412.
—— estimation of, in pig iron, ii, 244.
—— estimation of, in pyrites, ii, 63, 291, 411.
—— estimation of, in steel, ii, 244, 411.
—— estimation of, in urine, ii, 327, 528.
—— estimation of, in volatile organic compounds, ii, 136.
—— mode of combination of, in albumin, i, 691.
—— percentage of, in the hepatic and splenic cells at different ages, ii, 54.
—— precipitated, detection of traces of metallic sulphides in, ii, 137.
—— *precipitatum*, solubility of, in carbon bisulphide, ii, 261.
—— rate of oxidation of, ii, 213.
—— refractive indices of, in solution in carbon bisulphide, ii, 97.
—— solubility of, in carbon bisulphide at low temperatures, ii, 489.
Sulphuric acid, action of thionyl chloride on, ii, 43.
—— —— aqueous, volumes of, between 100° and 150°, ii, 307.
—— —— estimation of combined, in water, ii, 137.
—— —— estimation, volumetric, of, ii, 137.
—— —— formation of, in the animal organism, ii, 24.
—— —— molecular refraction of dissolved, TRANS., 838, 866.
—— —— solutions, freezing point of, ii, 106.
—— —— standardisation of, ii, 413.
—— anhydride, estimation of, in the products of combustion of coal gas, ii, 368.
Sulphurous anhydride, estimation of, in the products of combustion of coal gas, ii, 368.
—— —— hydrate of, ii, 44.
—— —— rate of escape of, from aqueous solutions of varying concentrations, TRANS., 877, 880.
Sumach, the glucosazone from, ii, 407.
Sunflower oil, properties of, and tests for, ii, 335.
Superphosphate, compounds of phos-

phoric acid soluble in water in, ii, 131.
Superphosphates, volumetric estimation of phosphoric acid, ii, 244, 290.
Suprarenal capsules, constituent of, yielding phosphorus and sugar, ii, 278.
—— —— physiological action of extract of, ii, 235, 405.
—— —— proteïds of, ii, 236.
—— gland, the physiologically active substance of, ii, 236.
Surface energy, molecular, of ethereal salts, ii, 40.
—— —— —— of non-associating liquids, ii, 40.
—— tension and osmotic pressure of solutions, relations between the, ii, 41.
Svabite, ii, 22.
Sylvanite from Stassfurt, ii, 504.
Syntonin, colour reactions of, ii, 376.

T.

Tadpoles, action of distilled water on, ii, 455.
—— influence of saline media on, ii, 239.
Tanacetone, identity of, with thujone, i, 619.
Tannin, estimation of, ii, 335.
—— from hops, i, 470.
—— of cider apples, oxidation of, i, 386.
Tannins, place of, in plant metabolism, ii, 324.
Tantalite, helium from, Trans., 689.
Tar, brown-coal, i, 258.
—— —— —— quinoline bases in, i, 243.
—— —— —— quinoline in, i, 392.
—— coal-, bases from, i, 390.
—— pine, i, 185, 294.
Tartaric acid, bismuth salt of, i, 92.
—— —— ketonic compound from, i, 449.
—— *a*-naphthalide, i, 106.
meso-Tartaric acid, synthetical formation of, i, 21.
—— nitrile, i, 21.
—— acetyl and benzoyl derivatives from, i, 21.
Tartrarsenic acid, salts of, Trans., 108.
Tartrarsenious acid, Trans., 105.
Tartrarsenites, metallic, Trans., 102.
Tartrates, rotatory power of, ii, 338.
Tautomerism, i, 257, 347.
Teeth of wild and tame rabbits, ii, 519.
Telluric acid, action of hydrogen sulphide on solutions of, Trans., 527, 543.
—— —— iodometric estimation of, ii, 30.
Tellurium, atomic weight of, Trans., 549.
—— estimation of, in copper bullion, ii, 289.
Temperature and electrolytic dissociation, relation between, ii, 203.
—— and the output of carbonic anhydride, ii, 452.
—— and vapour pressure, Van der Waal's formula for the relation between, ii, 153.
—— critical, ii, 6.
—— —— as a criterion of chemical purity, ii, 200, 304.
—— —— electrical conductivity near the, ii, 377.
—— —— of liquids holding solids in solution, ii, 201.
—— effect of, on phosphorescence, Proc., **1894**, 172.
—— functions, chemical equilibria as, ii, 211.
—— gradients of flames, Trans., 1050.
—— influence of, on the specific heat of aniline, ii, 199.
—— measurement of high, ii, 339.
—— of change, pressure of solution, as a means of determining, ii, 106.
—— pressure and volume relations of rarefied gases, ii, 38.
Temperatures, high, determination of, by means of platinum-resistance pyrometers, Trans., 160.
—— low, attainable with solid carbonic anhydride, ii, 498.
—— —— influence of, on the laws of crystallisation, ii, 42.
—— —— radiation at, ii, 253.
—— of flames, Trans., 1049.
—— of transformation of iron and steels, ii, 110.
—— transition of some racemates, ii, 380.
—— very low, physiological effect of, ii, 254.
Teraconic acid, synthesis of, i, 142,
Terephthalylbenzhydroxamic acid, i, 39.
Terephthalyldiamidoacetal, i, 90.
Terephthalyldiamidoacetaldehyde, i, 90.
Terephthalyldiamidoacetic acid, i, 91.
Terephthalylhydroxamic acid, i, 37.
Ternary mixtures, ii, 157.
Terpenes and ethereal oils, i, 59, 619, 621.
Terpene-series, isomerism in the, i, 672.
—— —— orientation in the, i, 152, 379, 549.

Terpenylic acid, constitution of, i, 548.
Terpilenol from *d*-eucalyptene, i, 673.
Terpin hydrate, action of phosphorus triiodide on, i, 59.
—— —— conversion of *d*- and *l*-linalol and of geraniol into, i, 639.
—— —— oxidation of, i, 548.
—— oxidation of, i, 548.
Terpineol, constitution of, i, 547.
—— optically active, i, 675.
—— oxidation products of, i, 548.
Tetanus cultures, action of sunlight on, ii, 58.
1 : 2 : 1′ : 4′-Tetracetoxynaphthalene, i, 151.
1 : 3 : 1′ : 4′-Tetracetoxynaphthalene, i, 614.
Tetracetylacetone, i, 498.
Tetracetylbenzaconine, Trans., 461.
Tetracetylphloretin, i, 538.
Tetracetyltriamidophenol, i, 459.
Tetrahydrocarbazole, bases obtained by the action of methylic iodide on, i, 54.
Tetrahydrocarvone, *l*-bisnitroso-4-bromo-, i, 551.
—— chloro-, i, 550.
—— physical properties of, i, 673.
—— oxime and semicarbazone of, i, 672.
—— semicarbazide compound of, i, 551.
Tetrahydrocarvonebisnitrosylic acid, i, 550.
Tetrahydrocinchonine, i, 630, 631.
—— nitrite, i, 631.
Tetrahydrofenchene, i, 380.
Tetrahydronaphthalic acid, i, 57.
—— anhydride, i, 57.
Tetrahydrophenylbenzoic acid, i, 98.
Tetrahydroquinazoline, salts of, i, 306.
—— thio-, oxidation of, i, 306.
Tetrahydroquinoline methohydroxide, identity of, with kairoline, i, 481.
Tetrahydro-*m*-toluidine and its carbamido- and phenylthiocarbamido-derivatives, i, 51.
1 : 2 : 3 : 5-Tetrahydroxybenzene, i, 458.
1 : 2 : 1′ : 4′-Tetrahydroxydihydronaphthalene, i, 477.
1 : 2 : 1′ : 4′-Tetrahydroxynaphthalene, i, 613.
1 : 3 : 1′ : 4′-Tetrahydroxynaphthalene, tetrachloro-, i, 614.
Tetrahydroxystearic acid, i, 501.
Tetrahydro-xylidine and its derivatives, i, 52.
1 : 2 : 1′ : 4′-Tetraketohexahydronaphthalene, hexachloro-, i, 614.
1 : 2 : 1′ : 4′-Tetraketotetrahydronaphthalene, tetrachloro-, i, 614.
Tetrametaphosphinimic acid, ii, 217.
Tetramethyldiacetylpyrocolline, i, 69.
Tetramethyldiamidobenzhydrol, i, 145.
Tetramethyldiamidobenzophenone, action of bromine on, i, 53.
Tetramethyldiamidodihydroxydiphenylmethane, i, 47.
—— derivatives of, i, 146.
Tetramethyldiamidodiphenylacetic acid, i, 171.
Tetramethyldiamidodiphenylamidoacetamide, i, 146.
Tetramethyldiamidodiphenylamidoacetic acid, i, 146.
Tetramethyldiamidodiphenylamidoacetonitrile, i, 145.
Tetramethyldiamidodiphenylcarbinol, instability of, i, 541.
—— oxide, i, 147.
—— oxidation of, i, 541.
Tetramethyldiamidodiphenylethylidene oxide, i, 47.
Tetramethyldiamidodiphenylglycollamide, i, 146.
Tetramethyldiamidodiphenylglycollic acid, i, 156.
Tetramethyldiamidodiphenylmethane, i, 98.
—— amido-, action of bromine on, i, 53.
—— oxide, i, 147.
Tetramethyldiamidotriphenylmethane, i, 56.
—— action of bromine on, i, 56.
Tetramethyldinitroazoxymethane, i, 446.
Tetramethylenedipiperidide, i, 681.
Tetramethyloxamide, i, 450.
Tetramethyltetramidodiphenylmethane, i, 98.
2 : 3 : 4 : 5-Tetramethylpyridine, i, 390.
Tetramethylsafranine, dinitro-, i, 278.
Tetrammoniotricuprammonium iodide, i, 330.
Tetraphenylhydrazine, Trans., 1091.
2 : 4 : 5 : 6-Tetraphenylpyridine, i, 48.
Tetrapyridine cobaltous chloride, i, 122.
Tetraquinoline cobaltous chloride, i, 122.
Tetra-*p*-tolylhydrazine, Trans., 1093.
Tetrazole, derivatives of, i, 193.
Tetrazolium bases, constitution of, i, 574.
Tetrethylquercetin, dibromo-, i, 387.
Tetrethylthiodiamine, i, 264.
Tetrolic acid, addition of bromine to, i, 591.
Thallium arsenite, ii, 218.
—— atomic weight of, ii, 166.
—— caesium bromides, ii, 398, 399.
—— —— chlorides, ii, 398, 399.
—— —— iodide, ii, 399.
—— hydrogen carbonate, ii, 316.
—— lithium chloride, ii, 399.
—— presence of, in hæmatite, ii, 505.
—— rubidium bromides, ii, 399.

Thallium rubidium chlorides, ii, 398.
—— —— iodide, ii, 399.
—— sodium chloride, ii, 399.
Thapsia resin, i, 385.
Thebaïne, i, 117, 402.
Thebaol, i, 402.
Thebaolquinone, i, 402.
Thebenine and its methiodide and ethiodide, i, 117.
Thebenol, i, 117.
Theobromine, estimation of, in cocoa nibs and cocoa, ii, 542.
—— m.p. of, ii, 379.
Thermal conductivity of metals, method for determining, ii, 69.
—— expansion of aqueous solutions, ii, 339.
Thermochemical carbon battery, ii, 302.
—— relations between acids, alcohols, and aldehydes, ii, 435.
—— researches on substitution in mineral chemistry, ii, 341.
Thermochemistry of mandelic acid, ii, 102.
—— of mercuric picrate, i, 131.
—— of the Bessemer process, ii, 432.
—— See also heat.
Thermodynamics of galvanic polarisation, ii, 198.
Thermoelectric phenomena between two electrolytes, ii, 152.
—— properties of platinoid and manganine, ii, 152.
—— —— of pure metals, ii, 99.
—— —— of salt solutions, ii, 68.
Thermometer, platinum-resistance, TRANS., 161.
Thermostat, ii, 378.
Thiamines, i, 264.
Thiazolecarboxylic acid, amido-, i, 73.
Thioacetic acid as a substitute for hydrogen sulphide in qualitative analysis, ii, 84.
—— —— preparation of, ii, 370, 415.
—— —— use of, in estimating arsenic, ii, 84, 370, 415.
Thioaniline, i, 87.
Thiocarbamide, substitution derivatives of, TRANS., 557.
Thiocarbimides, action of bromine on, i, 576.
Thiocarbonyldibenzenylamidoxime, i, 662.
Thiocarbonyldi-*p*-homobenzenylamidoxime, i, 662.
Thiocyanic acid, action of on gastric ferments, ii, 403.
—— —— estimation of, ii, 144.
—— —— in the juices of the stomach, ii, 361.
β-Thiocyano-ω-benzylacetophenone, i, 361.
Thiocyan-*o*-toluidine, i, 432.
Thiodiglycollic acid, i, 82.
Thiohydantoïnacetic acid, i, 13.
Thiohypophosphates, ii, 13, 389.
αα′-Thionaphthalene, TRANS., 642.
Thionyl chloride, action of on inorganic and organic acids, and aldoximes, ii, 43.
—— compounds of aromatic ethereal salts, i, 365.
Thionyl-*o*-azo-*p*-amidotoluene, i, 669.
Thionyl-*p*-azo-*o*-amidotoluene, i, 669.
Thionyl-*p*-azo-*o*-*p*-amidotoluene, i, 669.
Thionylbenzene-*p*-azonaphthylamine, i, 669.
Thionyldiethylamine, i, 430.
Thionyl-α-naphthylazo-α-naphthylamine, i, 669.
1 : 4-Thionylnaphthylenediamine, i, 670.
1-Thionylpiperidine, i, 430.
Thiophen, bromo-, action of sulphuric acid on, i, 86.
—— derivatives, i, 337.
—— estimation of, in benzene, i, 411, ii, 372.
—— mercury compounds of, i, 411.
—— ring, opening of, by piperidine, i, 681.
Thiophenyl-α-benzoyllactimide, α-bromo-, i, 284.
Thiosemicarbazide, m.p. of, i, 200.
Thiosulphuric acid, spontaneous decomposition of ii, 493.
Thiosulphurous acid, i, 258.
Thiourea, substitution derivatives of, TRANS., 556.
Thiouvinuric acid, preparation of, i, 73.
Thiuret, constitution of, i, 576.
Thorium chromate, ii, 357.
—— —— basic, ii, 357.
—— metahydroxide, ii, 49.
—— metaoxide and its hydrate, ii, 49.
Thrombosin, ii, 52, 235.
Thujamenthole, i, 620.
Thujamenthone, i, 621.
—— oxime and semicarbazones of, i, 672.
—— physical properties of i, 673.
—— semicarbazide derivative of, i, 621.
Thujene, preparation and properties of, i, 620.
Thujonamine and its derivatives, i, 619.
—— isomeride of, and its derivatives, i, 620.
iso-Thujonamine and its derivatives, i, 620.
Thujone, i, 620.
—— identity of tanacetone and salvone with, i, 619.
—— oximes, isomeric, i, 619.
—— physical properties of, i, 673.
—— tribromo-compounds derived from, i, 621.

iso-Thujone, i, 620.
—— oxime and semicarbazones of, i, 672.
—— physical properties of, i, 673.
Thymol, amido-, i, 546.
—— —— methyl ether hydrochloride, i, 547.
Thymolphthalide, preparation of, i, 602.
Thyroid gland, influence of the, on metabolism, ii, 516.
Ticonine, dibromo- rotatory power of, i, 116.
Tiglic acid, molecular interchange, in, i, 205.
—— —— oxidation of, i, 205.
Tigliceric acid, i, 205.
Tin arsenites, ii, 218.
—— freezing point of, Trans., 185.
—— oxysulphide, a new, ii, 19.
—— separation of copper from, ii, 89, 422, 463.
—— separation of lead from, ii, 89, 422, 462.
—— separation of lead, copper, silver, cadmium, cobalt, nickel, &c., from, ii, 89.
—— separation of mercury from, ii, 532.
—— thiohypophosphates, ii, 14.
Tin. See also Stannic and Stannous.
Tin-copper alloy, $SnCu_3$, ii, 351.
Tin-gold-silver-zinc alloys, assay of, ii, 294.
Tinctures, detection of methylated spirit in, ii, 91.
Tissues, glycolysis in, ii, 361.
Titanium, ii, 169.
—— amorphous, ii, 169.
—— carbide, ii, 272, 273.
—— cyanonitride, occurrence of, in ferromanganese, i, 487.
—— nitride, i, 272, 273; ii, 169.
—— preparation and properties of, ii, 272.
—— sesquisulphide (?), i, 170.
—— tetrachloride cyanobromide, ii, 170.
Titanium-copper alloy, ii, 169.
Tobacco, estimation of ammonia and nicotine in, ii, 541.
—— leaves, drying of, ii, 524.
Tobacco plant, ii, 524.
Toddalia aculeata, colouring matter of, Trans., 413.
Tolaneureïn, i, 305.
p-Tolenylamidoxime ethylic ether, i, 41.
—— methylic ether, i, 41.
p-Tolenylhydrazidine, i, 136.
p-Tolenylhydrazine benzoate, i, 137.
p-Toluacetodinitrile, i, 584.
—— bromo- and chloro-, i, 585.
Tolualdehydephenylhydrazone, *m*-amido-, i, 346.
Tolualdehydephenylhydrazone, *p*-amido-, i, 346.
Tolualloxazine, i, 688.
p-Tolubenzhydroxamic acids, i, 39.
Toluene, *p*-chloro-, sulphonation of, Proc., 1895, 153.
—— *m*-chloro-, synthesis of, from ethylic acetoacetate, i, 86.
—— 2 : 3-chloronitro-, Proc., 1895, 152.
—— 2 : 4-chloronitro-, Proc., 1895, 152.
—— condensation of, with glyoxylic acid, i, 526.
—— 2 : 3-dichloro-, Proc., 1895, 151.
—— —— sulphonation of, Proc., 1895, 151.
—— 2 : 4-dichloro-, Proc., 1895, 151.
—— —— sulphonation of, Proc., 1895, 151.
—— 2 : 6-dichloro-, Proc., 1895, 151.
—— —— sulphonation of, Proc., 1895, 151.
—— 3 : 5-dichloro-, Proc., 1895, 151.
—— —— sulphonation of, Proc., 1895, 152.
—— 2 : 3 : 5-dichloronitro-, Proc., 1895, 152.
—— *o*-iodo-, iodonium bases from, i, 529.
—— *p*-iodo-, iodonium bases from, i, 221.
—— *p*-nitro-, compound of, with aluminium chloride, i, 510.
—— —— condensation of, with formaldehyde, i, 148.
—— *m*-nitroso-, i, 217.
—— *o*-nitroso-, i, 217.
—— *p*-nitroso-, i, 217.
—— oxidation of, by incomplete combustion, i, 272.
—— symmetrical trinitro-, action of sod on, i, 654.
m-Tolueneazo-*p*-cresetoïl, i, 27.
p-Tolueneazo-*p*-cresetoïl, i, 27.
m-Tolueneazo-*p*-cresol, i, 26.
o-Tolueneazomaclurin, Trans., 934.
Toluene-2 : 6-disulphonic acid, Proc., 1895, 154.
—— chloride, Proc., 1895, 154.
Toluene-3 : 4-disulphonic acid, Proc., 1895, 154.
—— chloride, Proc., 1895 154.
Toluenedisulphonic acids, Proc., 1895, 152.
—— —— *o*-chloro- and *p*-chloro-, Proc., 1895, 152.
Toluenesulphonamide, 2 : 3-dichloro-, Proc., 1895, 151.
—— 2 : 6-dichloro-, Proc., 1895, 151.
—— 3 : 5-dichloro-, Proc., 1895, 152.
Toluene-2-sulphonamide, 4-chloro-, Proc., 1895, 153.

Toluene-3-sulphonamide, 4-chloro-, Proc., **1895**, 153.
—— 5 : 6-dichloro-, Proc., **1895**, 151.
—— 4 : 6-dichloro-, Proc., **1895**, 151.
Toluene-4-sulphonamide, action of carbonyl chloride on, i, 288.
Toluenesulphonic acid, *p*-nitro-, action of alkalis on, i, 287.
—— chloride, 2 : 3-dichloro-, Proc., **1895**, 151.
—— —— 2 : 6-dichloro-, Proc., **1895**, 151.
—— —— 3 : 5-dichloro-, Proc., **1895**, 152.
—— anilides, oxidation of, i, 369.
Toluene-2-sulphonic chloride, 4-chloro-, Proc., **1895**, 153.
Toluene-3-sulphonic chloride, 4-chloro-, Proc., **1895**, 153.
—— —— 4 : 6-dichloro-, Proc., **1895**, 151.
—— —— 5 : 6-dichloro-, Proc., **1895**, 151.
Toluene-4-sulphonic chloride, condensation of, with *o*-amidophenol, i, 369.
—— —— condensation of, with *p*-amidophenol, i, 369.
—— —— condensation of, with phenylhydrazine, i, 369.
p-Toluethylbenzhydroxylamine, i, 41.
m-Toluhydroxamic acid, i, 37.
p-Toluhydroxamic acid, i, 37.
m-Toluic acid, *p*-iodo-, i, 227.
—— —— symmetrical chloro-, i, 654.
o-Toluic acid, 5-bromo-, i, 228.
—— —— *o*-sulpho-, phthaleïns of, i, 183.
—— chloride, reduction of, Proc., **1894**, 216.
m-Toluidine, 2-chloro-, Proc., **1895**, 152.
—— 5 : 6-dichloro-, Proc., **1895**, 152.
—— *o*-sulphobenzoate, i, 472.
o-Toluidine, 6-chloro-, Proc., **1895**, 152.
—— 3 : 5-chloronitro-, Proc., **1895**, 152.
—— condensation of glyoxylic acid with, i, 171.
—— *o*-sulphobenzoate, i, 472.
p-Toluidine, 2-chloro-, Proc., **1895**, 152.
—— *o*-sulphobenzoate, i, 472.
p-Toluidine-aposafranine, i, 529.
o-Toluidoacetic *o*-toluidide, i, 144.
o-Toluidocaffeïne, i, 117.
p-Toluidocaffeïne, i, 117.
2-*o*-Toluido-4 : 5-diphenyldihydro-1 : 3-azoxole, i, 497.
o-Toluidohydroxy-α-naphthaquinone, i, 616.
p-Toluidohydroxy-α-naphthaquinone, i, 616.
p-Toluidomethylenecamphor, i, 63.
p-Toluido-β-naphthalene-*m*-azobenzoic acid, i, 238.
p-Toluido-β-naphthalene-*o*-azobenzoic acid, i, 239.
p-Toluido-β-naphthalene-*p*-azobenzoic acid, i, 238.
p-Toluoyl-*o*-benzoic acid, i, 422.
p-Toluoyl-*p*-methylimesatin, i, 368.
Toluoylnitroso-*p*-tolenylhydrazidine hydrochloride, i, 137.
Toluoyl-*p*-tolenylhydrazidine, i, 137.
m-Toluoyl-*o*-uramide, amido-, i, 524.
—— derivatives of, i, 524.
—— diamido-, i, 524.
—— dinitro-, i, 524.
—— nitro-, i, 524.
p-Tolupropiodinitrile, i, 585.
Toluquinol, nitro-, i, 513.
Toluquinone, condensation of, with ethylic acetoacetate, i, 225.
Toluresinotannol, i, 188.
o-Tolylazo-α-naphthol, *p*-nitro-, i, 353.
o-Tolylazo-β-naphthol, *p*-nitro-, i, 353.
n-*p*-Tolyl-ν-dibenzylthiourea, Trans., 558.
β-*m*-Tolyl-αγ-diketohydrindene, i, 535.
—— bromo-, i, 535.
—— chloro-, i, 535.
—— dioxime, i, 535.
—— phenylhydrazone, i, 535.
β-*m*-Tolyl-αγ-diketohydrindeneanilide, i, 535.
o-Tolyldiketotetrahydroquinazoline, i, 307.
Tolylenediamine, physiological action of, ii, 456.
p-Toluethyltoluhydroxylamine, i, 41.
o-Tolylhydroxydiphenylethylthiocarbamide, i, 597.
m-Tolylhydroxylamine, i, 217.
—— nitrosamine from, i, 217.
o-Tolylhydroxylamine, i, 217.
—— nitrosamine from, i, 217.
β-*o*-Tolylhydroxylamine, i, 417.
p-Tolylhydroxylamine, i, 217.
—— nitrosamine from, i, 217.
β-*p*-Tolylhydroxylamine, i, 417.
m-Tolylic benzoate, action of bromine on, i, 280.
o-Tolylic benzoate, action of bromine on, i, 280.
—— cinnamate, i, 365.
—— selenide, i, 512.
—— selenobromide, i, 512.
—— selenochloride, i, 512.
—— selenoxide, i, 512.
—— sulphide, i, 512.
—— telluride, i, 512.
—— tellurobromide, i, 512.
p-Tolylic arsenite, i, 340.
—— benzoate, action of bromine on, i, 280.

p-Tolylic cinnamate, i, 365.
—— diphenylamine-*n*-phosphinate, i, 364.
—— selenide, i, 512.
—— selenobromide, i, 512.
—— selenochloride, i, 512.
—— selenoxide, i, 512.
—— telluride, i, 512.
—— tellurobromide, i, 512.
—— thiocarbonate, i, 131.
p-Tolylimidoacetic acid, i, 525.
p-Tolylimidoacetyl-*p*-toluidide, i, 368, 525.
o-Tolylindazole, i, 307.
o-Tolyliodonium hydroxide and salts, i, 529.
o-Tolylketotetrahydroquinazoline, i, 307.
p-Tolyl-*p*-methylimesatin, i, 525.
o-Tolylnaphthalimide, i, 239.
n-*p*-Tolylnaphthimidazole, i, 58.
n-Tolylnaphthimidazole-β-benzene-*o*-carboxylic acid, i, 59.
n-Tolylnaphthimidazole-β-propionic acid, i, 59.
p-Tolylnaphthylenediamine, i, 58.
o-Tolylnitramine, i, 273.
—— *m*-nitro-, i, 273.
p-Tolylnitramine, i, 273.
—— *m*-nitro-, i, 273.
p-Tolyloxythiophosphazo-*o*-toluene, i, 463.
3-*p*-Tolylphenopyridazolone, i, 303.
p-Tolyltetrazoic acid, i, 137.
o-Tolylthiotetrahydroquinazoline, i, 307.
m-Tolylthiourea, Trans., 559.
p-Tolylthiourea, Trans., 1043.
p-Tolyl-μ-*p*-tolylinduline, i, 608.
Tourmaline from Bohemia, ii, 277.
—— from Colefax, Nevada Company, California, ii, 510.
Toxalbumins, precipitation of by nucleïc acid, i, 692.
Transpiration and assimilation of plants, ii, 175.
Trehalose, action of emulsin on, i, 442.
—— action of invertase on, i, 442.
—— formation in plants, time of, ii, 362.
—— in mushrooms, i, 199.
Triacetonamine, i, 327.
Triacetonemannitol, i, 441.
Triacetophenone, trithio-, i, 362.
Triacetoxyacetylamidobenzene, i, 458.
Triacetoxyaniline, i, 458.
Triacetylaconitine, Trans., 462.
Triacetylamidocarvacrol, i, 546.
Triacetyl-1-amido-2-hydroxyanthracene, i, 544.
Triacetyl-1-amido-2-hydroxyanthraquinone, i, 543.
Triacetyl-2 : 1 : 4-amidonaphthaquinol, i, 151.
Triacetyl-4 : 1 : 2-amidonaphthaquinol, i, 151.
Triacetyl-*p*-amidophenylauramine, i, 184.
Triacetylamidothymol, i, 547.
Triacetyl-β-arabinochloral, i, 321.
Triacetylbenzaconine, Trans., 460.
—— trihydrate, Trans., 461.
Triacetyl-β-dicatecholacetic acid, i, 367.
Triacetyl-β-dipyrogallolacetic acid, i, 367.
Triacetyldi-*p*-tolenylimidine, i, 138.
Triacetylgallic acid, i, 283, 368, 420.
—— —— dibromo-, i, 283.
Triacetyl-*o*-hydroxybenzyl-*o*-phenylenediamine, i, 346.
"Triacetylphloretin," i, 45, 538.
Triacetylpyraconitine, Trans., 463.
Triacetylrhamnazin, Trans., 498.
Triacetyltriamidophenol, i, 458.
Triamine cobalt salts, dinitro-, ii, 48.
Trianilidophenylphosphonium hydroxide and salts, i, 662.
Trianilido-*p*-tolylphosphonium hydroxide and salts, i, 662.
Trianiline-*n*-phosphine oxide, tri-*p*-chloro-, i, 364.
Triazole, preparation of, i, 74.
Triazoles, i, 73.
Tribenzamide, synthesis of, i, 289.
Tribenzoylhydroxylamine, i, 41.
Tribenzoylrhamnazin, Trans., 499.
Tribenzoyltrimethylenetriamine, i, 326.
Tribenzylamine, *o*-nitro-, i, 307.
Tribenzylic ψ-imidodicarboxylate, trithio-, i, 605.
Tribenzylideneiditol, i, 650.
Tribenzylidenerosaniline, trinitro-, i, 234.
Tribenzylthiourea, Trans., 557.
Trichophytons, physiology of, ii, 457.
Triethylphloroglucinol, i, 338.
—— phenylhydrazone of, i, 339.
Triethyltriketohexamethylene, i, 338.
—— phenylhydrazone of, i, 339.
Trigonelline, occurrence of, in agricultural seeds, &c., ii, 364.
Trihydroxyazoxybenzoic acid, i, 531.
Trihydroxybenzene, amido-, i, 458.
Trihydroxyhexahydrocymene, constitution of, i, 674.
1 : 2 : 4-Trihydroxyhexane, i, 489.
1 : 2 : 4-Trihydroxy-*iso*-hexane, i, 489.
—— triacetate, i, 489.
1 : 2 : 4-Trihydroxy-*iso*-octane, i, 489.
—— triacetate, i, 489.
Trihydroxyphenylbutyric acid, salts of, i, 92.
Trihydroxyphenylbutyrolactone, nitro-, i, 92.

Trimetaphosphinimic acid, ii, 217.
Trimethylammoniumtetramethyldiamidotriphenylmethane methoxide, iodo-, i, 377.
Trimethylbenzaldoxime, symmetrical, i, 356.
Trimethylbenz-*anti*-aldoxime, i, 356.
Trimethylbenz-*syn*-aldoxime, i, 356.
Trimethylbenzodifurfuranedicarboxylic acid, i, 226.
2 : 4 : 6-Trimethyl-β-benzoylpropionic acid, i, 467.
Trimethylcyanopropionic acid, Trans., 425.
Trimethyldihydroquinoline, i, 111, 392.
Trimethyldihydroquinolineazobenzene, i, 69.
Trimethylene, action of chlorine on, i, 2.
—— dipiperidine, i, 681.
Trimethylenecarboxylic acid, action of, bromine on, Trans., 118.
—— —— physical properties of, Trans., 116.
cis-1 : 2-Trimethylenedicarboxylic acid, i, 269.
trans-1 : 2-Trimethylenedicarboxylic acid, i, 269.
Trimethylenepolycarboxylic acids, i, 169.
cis-1 : 2-*trans*-1 : 3-Trimethylenetetracarboxylate, i, 269.
trans-1 : 2 : 3-Trimethylenetricarboxylic acid, i, 269.
—— —— amide and anhydro-acid from, i, 269.
2 : 4 : 6-Trimethylethylbenzene, i, 655.
Trimethylethylene, magnetic rotation of, Trans., 256.
αββ-Trimethylglutaric acid, i, 552, 679.
Trimethyloxamide, i, 450.
Trimethyl-*m*-phenylenediamine, nitro-, compound of, with symmetrical trinitrobenzene, i, 653.
Trimethylphloretin, i, 538.
—— methyl ether, i, 538.
1 : 3 : 5-Trimethylpyrazole, 4-amido-, i, 397.
—— 4-iodo-, i, 398.
—— 4-nitro-, i, 397.
3 : 4 : 5-Trimethylpyrazole, i, 688.
3 : 4 : 4-Trimethylpyrazolone, i, 687.
1 : 2 : 3-Trimethyl-*iso*-pyrazolone, i, 687.
Trimethylsuccinanil, i, 209.
Trimethylsuccinanilic acid, i, 209.
Trimethylsuccinic acid, Trans., 416; i, 209, 505.
—— —— preparation of, i, 505.
—— —— preparation of, by Bischoff's reaction, Trans., 431.
—— anhydride, Trans., 428.
Trimethylsuccin-β-naphthil, i, 209.
Trimethylsuccin-β-naphthilic acid, i, 209.
Trimethylsuccin-*p*-tolil, i, 209.
Trimethylsuccin-*p*-tolilic acid, i, 209.
Trimethylthiourea, Trans., 557.
Trimethyltrimethylenetriamine, i, 325, 641.
—— picrate, i, 325.
Trioxymethylene, action of glycerol on, i, 333.
Triphenazinoxazine, i, 220.
3 : 4 : 5-Triphenyl-6-acetyl-Δ_2-ketotetrahydrobenzene, i, 50.
Triphenylacrylamide, i, 542.
Triphenylacrylic acid, i, 542.
Triphenylacrylonitrile, i, 542.
Triphenylbenzene, i, 49.
Triphenylcarbinol, sulphone of, i, 285.
αβν-Triphenylglyoxaline μ-ethosulphide, i, 305.
—— μ-hydrosulphide, i, 305.
—— μ-methosulphide, i, 305.
3 : 4 : 5-Triphenyl-Δ_2-ketotetrahydrobenzene, i, 49.
iso-3 : 4 : 5-Triphenyl-Δ_2-ketotetrahydrobenzene, i, 49.
Triphenylmethane series, sulphonated colouring matters of, i, 539.
—— sulphone of, i, 285.
—— trinitro-, sulphone of, i, 284.
Triphenylmethane-colouring-matters, i, 423.
—— —— —— action of nascent bromine on, i, 55.
—— —— —— and their constitution, i, 56, 234, 378, 423, 539.
—— —— —— non-dissociation of the chlorides of, in water, i, 377.
Triphenylpyridazolone, i, 180.
Triphenylsulphonethane, i, 96.
Triphenylthienylmethane, i, 543.
Triphenylthiobiuret, i, 577.
Triphenyltrimethylenetriamine, i, 642.
Triphosphoric acid, ii, 445.
Tripiperidine-*n*-phosphine, i, 682.
—— sulphide, i, 683.
Triricinoleïn, i, 500.
—— condensation of, i, 500.
Trithiophenylethane, i, 96.
Tubes, sealed, heating apparatus for, ii, 216.
Tubifex rivulorum, action of distilled water on, ii, 455.
—— —— influence of saline media on, ii, 239.
Tungsten, action of nitric oxide and peroxide on, ii, 396.
—— action of sulphurous anhydride on, ii, 396.
—— atomic weight of, ii, 230.
—— dioxide, action of nitrous oxide on, ii, 312.

Tungsten, pure, preparation of, ii, 230.
—— reduction of ferric chloride by, ii, 398.
—— separation of arsenic from, ii, 416.
—— specific heat of, ii, 199.
Tungstic acid, acidimetric estimation of, ii, 85.
—— anhydride, action of acetylene on, ii, 397.
—— —— action of ethylene on, ii, 397.
—— —— action of phosphine on, ii, 397.
—— —— action of phosphorus pentachloride on, ii, 396.
—— —— reduction of, by aluminium, zinc, or magnesium, ii, 397.
Turkey-red oil, i, 82.
Turnbull's blue, attempts to ascertain the composition of, i, 486.
Turpentine, Finland, i, 545.
Tyrolite, composition of, ii, 507.

U.

Ulexine, i, 254.
—— and cytisine, identity of, i, 119.
Undecanonic acid, i, 447.
—— —— oxime, i, 447.
iso-Undecylamine, i, 324.
iso-Undecylammonium *iso*-undecylthiocarbamate, i, 324.
iso-Undecylcarbamide, i, 324.
iso-Undecylthiocarbamide, i, 324.
iso-Undecylthiosemicarbazide, i, 324.
Uracil, amido-, action of nitrous acid on, i, 328.
Uraninite, new gas from, ii, 469.
—— spectrum of the gas obtained from, ii, 431.
Uranium, estimation of, in earths containing phosphoric and arsenic acids, ii, 536.
Uranous oxide, action of nitrous oxide on, ii, 312.
Urate sediments, colouring matters of, i, 315.
Urazole, i, 73, 253.
—— imidodithio-, i, 401.
—— dithio-, i, 400.
Urazoles, i, 73.
Urbanite from Långban mines, Sweden, ii, 513.
Urea and silver nitrate, interaction of, Trans., 765.
—— estimation of, by Riegler's method, table for, ii, 190.
—— estimation of, in blood, ii, 299.
—— estimation of, in urine, ii, 138, 541.
—— in arterial and venous blood, ii, 236.
Urea, substitution derivatives of, Trans., 556.
—— transformation of ammonium cyanate into, Trans., 746.
—— See also carbamide.
Ureïdes, affinity constants of, ii, 310.
Ureometer, new mercury, ii, 138.
Urethane, action of nitrosyl chloride on, Trans., 491.
Uric acid, action of iodine and potassium iodide on, i, 84.
—— —— and xanthine bases, estimation of, in urine, ii, 373.
—— —— crystals deposited from urine, pigmentation of, ii, 55.
—— —— estimation of in urine, ii, 190, 373, 538.
—— —— excretion of, ii, 520.
—— —— hydrate of, i, 270.
—— —— oxidation of, i, 129.
—— —— separation of adenine and hypoxanthine from, ii, 94.
—— —— stones in urine, piperazine as a solvent for, ii, 56.
Urine, acidity of, ii, 55, 279, 520.
—— amount of iron in, ii, 407.
—— analysis of, ii, 143.
—— detection and estimation of albumin in, ii, 542.
—— detection of acetone in, ii, 537.
—— detection of bile pigment in, ii, 336.
—— detection of glucose in, ii, 334.
—— detection of iodine in, ii, 136.
—— detection of small quantities of sugar in, ii, 537.
—— diabetic, pentoses in, ii, 406.
—— effect of carbohydrates on the production of sugar in, ii, 406.
—— estimation of acetone in, ii, 407.
—— estimation of albumin in, ii, 190, 542.
—— estimation of chlorine in, ii, 62.
—— estimation of iron in, ii, 407.
—— estimation of proteïd in, ii, 237.
—— estimation of sulphur in, ii, 327, 528.
—— estimation of total nitrogen in, ii, 327.
—— estimation of urea in, ii, 138, 541.
—— estimation of uric acid in, ii, 90, 373, 538.
—— estimation of xanthine-like substances in, ii, 94, 373, 538.
—— ethereal hydrogen sulphates in urine, ii, 55.
—— normal, carbohydrates of, ii, 82.
—— —— hæmatoporphyrin in, ii, 55.
—— —— saturation of, with neutral salts, ii, 237.
—— of persons taking sulphonal, apparent presence of sugar in, ii, 406.

Urine of rabbits poisoned by carbonic oxide, lactic acids in, ii, 175.
—— of the dog, ethylic sulphide in, ii, 81.
—— peptone in the, ii, 25.
—— pigmentation of uric acid crystals deposited from, ii, 55.
—— piperazine as a solvent of uric acid stones in, ii, 56.
—— source of sugar in, ii, 360.
—— test for, in water, ii, 332.
—— yellow colouring matter of, i, 690.
Uroerythrin, i, 315.
Uroxanic acid, i, 129.
Usnea barbata var. ceratina, usnic acid and other substances from, i, 298.
—— —— *var. florida* and *hirta*, carbonusnic acid in, i, 299.
Usnic acid and its derivatives, i, 298.
—— —— diphenylhydrazone of, i, 299.
—— anhydride, i, 298.
Usnolic acid, i, 299.
Uvinuric acid, thio-, preparation of, i, 73.

V.

Vacuum pump, automatic, ii, 311.
Valeraldehyde, preparation of, i, 168.
iso-Valeraldehyde, brom-, i, 317.
—— condensation of, i, 643, 644, 645.
—— condensation of acetone with, i, 645.
—— condensation of glutaric acid with, i, 127.
iso-Valeramide, heat of formation of, ii, 483.
Valeric acid, affinity constant of, ii, 253.
—— —— β-bromo-, action of water on, i, 205.
—— —— dibromo-, i, 510.
—— acids, bromo- and dibromo-, crystalline form of, i, 205.
—— chloride, normal, i, 174.
iso-Valeric acid, affinity constant of, ii, 253.
iso-Valeric acid, β-bromo-, i, 411.
—— —— αβ-dibromo-, i, 16.
—— —— chloride, reduction of, Proc., **1894**, 216.
n-Valeryl-ν-benzylphenylthiourea, Trans., 1044.
iso-Valerylidenebutyric acid, i, 128.
iso-Valerylideneglutaric acid, i, 127.
—— anhydride, i, 128.
ab-Valeryl-α-naphthylthiocarbamide, Trans., 1044.
iso-Valerylphenylhydrazine, i, 649.
ab-Valerylphenylthiocarbamide, Trans., 1041.
Valerylthiocarbimide, derivatives of, Trans., 1040.
Valerylthiourea, Trans., 1045.
Valeryl-β-thiourethane, Trans., 1045.
Valeryl-*o*-tolylcarbamide, Trans., 1043.
ab-Valeryl-*o*-tolylthiocarbamide, Trans., 1042.
ab-Valeryl-*p*-tolylthiocarbamide, Trans., 1043.
Vallonia, the glucosazone from, ii, 407.
Valve, safety, for filter pumps, ii, 346.
Vanadic anhydride and molybdic anhydride, estimation, volumetric, of in the same solution, ii, 535.
Vanadium in commercial caustic soda, ii, 49.
—— separation of arsenic from, ii, 416.
—— trioxide, action of nitrous oxide on, ii, 312.
Vanillin, occurrence of, in the flowers of *Nigritella suaveolens*, ii, 129.
Vanillinacetic acid, i, 603.
Vapour, liquefaction of, ii, 201.
—— pressure and temperature, van der Waals' formula for the relation between, ii, 153.
—— —— of a liquid at a constant temperature, influence of the relative volumes of liquid and vapour on, ii, 203.
—— —— of the combined water in copper sulphate and in barium chloride, ii, 486.
—— pressures of a substance in the solid and liquid state, relation between, ii, 104.
—— —— of normal hexane, Trans., 1071, 1074.
Vapours, dissolution of solids in, ii, 255.
—— saturated, density of, ii, 342.
Vegetable assimilation and respiration, ii, 520.
—— feeders, does inulin lead to the formation of glycogen in, ii, 404.
—— matter, estimation of iron in the, ii, 89.
—— principles that decompose with liberation of carbonic anhydride, ii, 124.
—— substances, examination of, for argon, ii, 516.
Vegetables, lower, action of dilute alkalis, on, ii, 174.
Vegetation, effect of arsenic on, ii, 410.
—— effect of chlorides on, ii, 61.
—— influence of atmospheric ozone on, ii, 240.
Vellosine and its salts, i, 194.
—— methiodide, i, 195.
Velocities of the ions, ii, 477.
Velocity of etherification of isomeric substituted benzoic acids, i, 467.
—— —— of methylic alcohol, ii, 258.

Velocity of formation of amines and alkylammonium salts, ii, 385.
—— of reaction between alkylic sulphides and alkylic iodides, ii, 8.
—— —— between ferric and stannous chlorides, ii, 257.
—— —— effect of hydrolysis on, ii, 159.
—— —— in the oxidation of acetaldehyde, ii, 215.
—— —— in the oxidation of phosphorus, ii, 213.
—— —— in the oxidation of sulphur, ii, 213.
—— —— of potassium hypoiodite, ii, 213.
—— of transformation of ammonium cyanate into urea, Trans., 751.
Veratric acid, amido-, i, 367.
—— —— formation of, from hemipinic acid, i, 367.
—— aldehyde, dibromo-, i, 656.
Veratrylpseudaconine, Proc., 1895, 155.
Vertebrates, egg-shells of, ii, 54.
Vessels, measuring, apparatus for the rapid calibration of, ii, 368.
Vestrylamine, i, 152.
Vesuvians, composition and constitution of, ii, 319, 511.
Vicia sativa, crystalline nitrogen compounds in the seedlings of, ii, 84.
—— —— germinating process in, ii, 124.
Vinaconic acid, constitution of, i, 171.
—— —— identity of, with trimethylenedicarboxylic acid, i, 172.
o-Vinylbenzoic acid, chloro-, i, 57.
o-Vinylbenzoylcarboxylic acid, chloro-, i, 57.
Vinylphenyliodinium nitrate, chloro-, i, 635.
Vinyltriphenylsulphone, i, 96.
Vinyltrithiophenyl, i, 96.
Vinylquinoline, i, 71.
Visual purple, ii, 361.
Volemite, a new heptitol, i, 639.
Volemose and its osazone, i, 639.
Voltaic cell containing magnesium, ii, 35.
—— combinations with a fused electrolyte and a gaseous depolariser, ii, 66.
Volume change on neutralisation, ii, 204.
—— changes in elements during melting, ii, 5.
—— of salts in their aqueous solutions, ii, 486, 487.
—— pressure and temperature relations of rarefied gases, ii, 38.
Volumes, atomic. See Atomic Volumes.
—— specific, of normal hexane, Trans., 1071, 1075.
Volumetric apparatus, instruments for the graduation and calibration of, i, 134.
—— method, new, ii, 326.
Vulcanite, a new rock, ii, 277.
Vulpic acid, in various lichens, i, 298.
—— —— synthesis and constitution of, i, 99.

W.

Water, change in the specific heat of, between 0° and 32°, ii, 5.
—— determination of the freezing point of, ii, 105.
—— distilled, action of, on animal organisms, ii, 455.
—— drainage, loss of nitrogen in, ii, 286.
—— —— of cultivated land, ii, 133, 458.
—— drinking, purification of, i, 260.
—— estimation of combined sulphuric acid in, ii, 137.
—— estimation of, in silicates, ii, 325.
—— estimation of the hardness of, ii, 32, 84.
—— from the Eastern Mediterranean, ii, 51.
—— influence of on chemical change, Trans., 1139.
—— magnetic rotation of, ii, 474.
—— molecular complexity of, ii, 41.
—— of crystallisation, ii, 488.
—— —— of organic compounds, heat of combination of, ii, 202.
—— of the brine springs of Torda, Hungary, ii, 118.
—— of the Kolop sulphur spring, ii, 118.
—— of the Sea of Marmora, ii, 515.
—— specific heat of, at constant volume, ii, 6.
—— specific inductive capacity of, ii, 197.
—— temperature of maximum density of, ii, 343.
—— test for urine and excreta in, ii, 232.
Waters, estimation of organic matters in, by titration with potassium permanganate, ii, 90.
Wax found in the treatment of cotton and linen fibre for the manufacture of paper, i, 409.
—— free acids in, i, 81.
—— from *Polygonum cuspidatum*, Trans., 1089.
—— mineral, from Kaluga, ii, 20.
Wheat, experiments on, at Grignon in 1894, ii, 179.
—— germination of, ii, 521.
Williamson's violet, attempts to ascertain the constitution of, i, 487.
Wine, analysis of, ii, 463.

Wine, estimation of potassium sulphate in, ii, 418.
—— estimation of mannitol in, ii, 334.
—— estimation of salicylic acid in, ii, 426.
—— estimation of volatile acids in, ii, 538.
—— formation of mannitol in, i, 199.
Wines, Austro-Hungarian, sweet, analyses of, ii, 465.
—— sweet, ratio of *d*-glucose to levulose in: use of the ratio in detecting adulteration, ii, 188.
Wood, gases formed in the action of nitric acid on, i, 323.
Wool grease, estimation of chlorine in, ii, 326.
Work, maximum, the principle of, and entropy, ii, 42.
—— muscular, sugar as the source of, ii, 233.
Wort, estimation of cane sugar in, ii, 93.

X.

Xanthine bases and uric acid, estimation of, in urine, ii, 373.
Xanthine-like substances, estimation of, in urine, ii, 94, 373, 538.
Xenotime, helium from, Trans., 688.
m-Xylene, 5-chloro-, synthesis of, from ethylic acetoacetate, i, 86.
—— 5 : 4- (or 5 : 2-) chloronitro-, i, 654.
—— symmetrical chlorotrinitro-, i, 654.
—— trinitro-, action of soda on, i, 654.
o-Xylene, freezing point of, ii, 207, 273.
—— tetrabromo-, i, 568.
p-Xylene, action of cyanogen chloride on, i, 257.
—— as a solvent in cryoscopic investigations, ii, 207.
Xylenesulphonic acid, symmetrical chloro-, i, 86.
m-Xylidine, symmetrical trinitro-, i, 654.
m-Xylidocaffeïne, i, 117.
Xylosehydrazonediphenyl, i, 97.
Xylosochloral, i, 321.
Xylylenediamines, action of sulphurous anhydride on, i, 346.
—— action of thionylaniline on, i, 345.
Xylylmethane, amido-, i, 634.
—— nitro-, i, 634.
β-*p*-Xylylhydroxylamine, i, 417.
3-Xylylphenopyridazolones, i, 303.

Y.

Yeast, beer, dialysis of, ii, 83.
—— behaviour of, towards glycogen, ii, 322.
Yeast, carbohydrates of, i, 166.
—— compressed, estimation of starch in, ii, 93.
—— enzymes of, i, 162.
—— extract, action of, on glucosides, i, 6, 7.
—— hydrolysis of maltose by, Proc., **1895**, 46.
—— poisonous action of the hydroxybenzenes on, ii, 130.
Yeast-glucase, i, 429.
Yeast-gum, i, 166.
Ylangol, i, 243, 294.
Ylang-ylang, essence of, i, 243, 294.
Yttrium, atomic weight of, ii, 269.
Yttrium-cerium group, not yet thoroughly characterised elements of, Trans., 477.
—— —— perfectly characterised elements of, Trans., 475.
Yttrotantalite, helium from, Trans., 687.

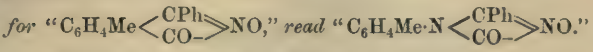
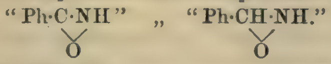
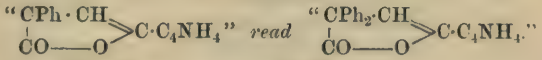
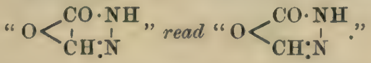
Z.

Zinc, action of, on moist nitrous oxide, ii, 495.
—— ammonium lactates, active, preparation of, Trans., 617.
—— —— sulphate, molecular refraction of dissolved, Trans., 838.
—— arsenite, ii, 218.
—— detection and estimation of, in oils, ii, 463.
—— dichromate mercury cyanide, ii, 356.
—— estimation of, ii, 291.
—— estimation, volumetric, of, ii, 371, 418.
—— freezing point of, Trans., 185.
—— moist, reduction of nitric oxide by, ii, 445.
—— ores, analysis of, ii, 139.
—— oxidising, action of ammonia solution on, Proc., **1895**, 9.
—— potassium sulphate, molecular refraction of dissolved, Trans., 838.
—— powder, presence of ammonia in, ii, 109.
—— purification of, ii, 390.
—— separation, electrolytic, of iron and cobalt from, ii, 89.
—— separation of copper from, ii, 246.
—— sodium triphosphate, ii, 447.
—— sulphate, action of potassium hydroxide on, ii, 418.
—— —— molecular refraction of dissolved, Trans., 838, 866.
—— sulphide, basic and acidic, ii, 267.
—— sulphide, precipitated, crystallisation of, ii, 267.

Zinc sulphide, protomorphic state of, ii, 224.
—— —— transformation of, ii, 266.
—— thiohypophosphate, ii, 13, 389.
Zinc-chromium alloy, ii, 351.
Zinc-copper alloy, Zn_2Cu, ii, 351.
—— alloys, analysis of, ii, 186.
Zinc-gold-silver-tin alloys, assay of, ii, 295.
Zincmethyl, apparatus for the distillation of, ii, 215.
Zinckenite, from Oruro, Bolivia, ii, 171.
Zinnwaldite from Mourne Mountains, Co. Down, ii, 512.
Zirconia, native, ii, 505.
Zirkelite from Brazil, ii, 508.
Zone reactions and their use in testing for acids, ii, 135.

ERRATA.

Vol. LVIII (Abstr., 1890).

Page	Line	
43	9*	 *for* "$\mathrm{C_6H_4Me}<\begin{matrix}\mathrm{CPh}\\ \mathrm{CO-}\end{matrix}>\mathrm{NO}$," *read* "$\mathrm{C_6H_4Me\cdot N}<\begin{matrix}\mathrm{CPh}\\ \mathrm{CO-}\end{matrix}>\mathrm{NO}$."
721	8*	,, "$\mathrm{NH_2\cdot NMe}$" *read* "$\mathrm{NH_2\cdot NOMe}$."
970	17*	 ,, "$\mathrm{Ph\cdot}\underset{\diagdown\mathrm{O}\diagup}{\mathrm{C\cdot NH}}$" ,, "$\mathrm{Ph\cdot}\underset{\diagdown\mathrm{O}\diagup}{\mathrm{CH\cdot NH}}$."
1000	12*	 ,, "$\begin{array}{l}\mathrm{CPh\cdot CH}\\ \mid\\ \mathrm{CO{-}{-}O}\end{array}>\mathrm{C\cdot C_4NH_4}$" *read* "$\begin{array}{l}\mathrm{CPh_2\cdot CH}\\ \mid\\ \mathrm{CO{-}{-}O}\end{array}>\mathrm{C\cdot C_4NH_4}$."
1440	9*	 ,, "$\mathrm{O}<\begin{array}{l}\mathrm{CO\cdot NH}\\ \mid\quad\ \ \mid\\ \mathrm{CH{:}N}\end{array}$" *read* "$\mathrm{O}<\begin{array}{l}\mathrm{CO\cdot NH}\\ \qquad\ \mid\\ \mathrm{CH{:}N}\end{array}$."

Vol. LX (Abstr., 1891).

Page	Line	
57	10*	*for* "azoinide" *read* "azoimide."
442	3*	,, "ketoximes" *read* "aldoximes."
653	14*	*after* "bromonitropropane" *insert* "and zinc-methyl."
1008	4*	*for* "yield three" *read* "yield two."

Vol. LXIV (Abstr., 1893).

Part II.

Page	Line	
536	17*	*for* "hydrargilite" *read* "hydrargillite."
577	24	,, "$2PO_4CaH_2 + 3H_2O$" *read* "$2PO_4CaH + 3H_2O$."

Vol. LXVI (Abstr., 1894).

Part I.

Page	Line	
438	5*	*for* "$C_3H_5O_2(CH_2)_2OH$" *read* "$C_3H_5O_2(CH_2)\cdot OH$."

Part II.

Page	Line	
283	13	*for* "A shows three points of transformation" *read* "A, like carburetted iron, shows three points of transformation at which there is thermal change."
290	3*	,, "observed" *read* "obscured."
291	5 & 6	,, "*Sapindus*, *Saponaria*, and *Esculentus*" *read* "*Sapindus saponaria* and *S. esculentus*."
291	6	,, "*Amara*" *read* "*P. amara*."
496	17, col. ii,	*for* "Beneville, J. S. de" *read* "Benneville, J. S. de."

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* From bottom.

VOL. LXVIII (ABSTR., 1895).

PART I.

Page	Line	
5	16*	*for* " ECKENSTEIN " *read* " EKENSTEIN."
40	13	,, " $CPh{\cdot}C(NO{\cdot}CO{\cdot}C_7H_7){\cdot}OEt$ " *read* " $OEt{\cdot}CPh{:}N{\cdot}O{\cdot}CO{\cdot}C_7H_7$."
53	13	,, " converted into " *read* " obtained from."
92	4	,, " WILLSTÄTER " *read* " WILLSTATTER."
116	21*	,, " CRÄMER " *read* " CRAMER."
281	12	,, " CÆSARIS " ,, " CESARIS."
334	bottom	,, " *ethylic para-φ-diketosebate* " *read* " *ethylic γφ-diketosebate.*"
345	19*	,, " sulphuric acid " *read* " nitric acid."
345	18*	,, " zinc dust and glacial acetic acid " *read* " alcoholic ammonium sulphide."
368	4	*for* " *paratoluidineacetoparatoluidide* " *read* " *paratolylimidoacetylparatoluidide.*"
525	18*	
382	5, 7	,, " Citron oil " *read* " Lemon oil."
428	11*	,, " Dihydrocampholenolactone " *read* " Hydroxydihydrocampholenolactone."
451	23*	,, " d-*Phenylacetic* " *read* " d-*Phenylchloracetic.*"
525	9*	,, " *Paratoluidineacetic acid* " *read* " *Paratolylimidoacetic acid.*"
603	12*	,, " OSCAR " *read* " OSKAR."
659	6*	,, " $N_2Ph{\cdot}CH(CN){\cdot}COOEt$ " *read* " $C_6H_4Br{\cdot}N_2{\cdot}CH(CN){\cdot}COOEt$."

PART II.

Page	Line	
20	2, 14*, 1*	*for* " *Zeit. Kryst. Min.*, **33** " *read* " *Zeit. Kryst. Min.*, **23**."
21	8, 13*	
22	7*	
23	13*	
20	15	*for* " E. K. DUMBLE " *read* " E. J. DUMBLE."
21	19	,, " titaniferous " *read* " titanic."
22	16	,, " 1 " *read* " 50—64."
22	18	,, " occurs " *read* " occurs at the latter locality."
76	20	,, " $3RO,SiO_2,R_2O_3,SiO_2$ " *read* " $3(RO,SiO_2),R_2O_3,SiO_2$."
101	3, 23*	,, " LOUGUININE " *read* " LUGININ."
120	14*, 12*	,, " pancreatic " ,, " gastric."
129	13*	,, " stability " *read* " lability."
172	19*	,, " **Laurium** " ,, " **Laurion.**"
267	18*, 16*	,, " **spark discharge** " *read* " **silent discharge.**"
332	15*	,, " **Diazobenzenesulphonic** " *read* " **Paradiazobenzenesulphonic.**"
335	21*	,, " GERARD " *read* " GÉRARD."
402	17, 6*	,, " **triolite** " *read* " **troilite.**"
403	15*	,, " **starch** " ,, " **starch paste.**"
408	21	,, " of *Folia Bucco* " *read* " in Folia Bucco (Buchu leaves)."
505	15	,, " rhodocrosite " *read* " rhodochrosite."
541	4	,, " citron oil " *read* " lemon oil."
576	30, col. ii,	*for* " **Manassee** " *read* " **Manasse.**"
576	3*, col. ii,	,, " *Jeans Charles Gallissard* " *read* " *Jean Charles Galissard.*"
579	14,* col. i	*for* " **Morell** " *read* " **Morrell.**"
587	10, col. ii	

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* From bottom.

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